



**Canadian Industry
Program for
Energy Conservation**

1986

The Canadian Industry Program for Energy Conservation (CIPEC) is an industry-administered/government-sponsored program for promoting and monitoring energy efficiency throughout the Canadian manufacturing and mining industries.

CIPEC was established on May 23, 1975, as a result of deliberations between the federal Ministers of Energy, Mines and Resources, and Industry, Trade and Commerce, and 50 of industry's most senior representatives. It now consists of 14 industrial task forces

representing a broad spectrum of Canadian manufacturing and mining.

Program objectives were originally designed to coordinate various industry energy conservation efforts to combat the threat of Middle East "oil embargoes" and the subsequent rapid escalation of energy costs. Over the past 11 years, the scope of the program objectives and activities has been broadened to keep pace with the changing energy management scene.

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CANADIAN
INDUSTRY PROGRAM
FOR ENERGY CONSERVATION

PROGRAMME CANADIEN
D'ÉCONOMIE D'ÉNERGIE
INDUSTRIELLE



August 19, 1987

The Honourable Marcel Masse, P.C., M.P.
Minister, Energy, Mines and Resources
House of Commons
Ottawa, Ontario
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Dear Minister:

The year 1986 saw a remarkable drop in oil prices, but some rebound has occurred as a result of the recent events in the Persian Gulf. Once again this demonstrates to us the potential for disruption in world oil supplies and unpredictable distortions in market-force pricing of energy.

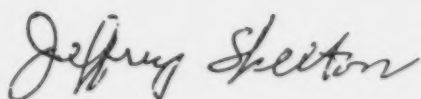
In the face of this situation, we feel the efforts of the Canadian Industry Program for Energy Conservation (CIPEC) to help improve operating efficiency continue to be relevant and timely. As well, the re-emphasized national importance of energy conservation, as outlined in your recent initiative, "Energy Options — A Canadian Dialogue", is a most encouraging development.

We are therefore pleased to report that progress to date has been substantial. Energy conservation, as reported by CIPEC members during 1986, showed an improvement of 1.7%, which translates into a savings of \$2.9 billion in manufacturing expenses. Compared with the 1973 operating standards, total efficiency has improved 25.8%. But future incremental savings are becoming more difficult to achieve now that the earlier solutions have been completed and we must all work harder at this task.

My first year as Council Chairman has indeed been a rewarding one, in part due to the effective work of the previous Chairman, William Cowling. Recognition should also go to our newly appointed Vice-Chairman, Peter Torbet, of 3M Canada Inc., for his assistance during the year. I would especially like to thank all the members of the Task Force Council and the staff of your Business and Government Energy Management Division who continue to be willing, helpful, and co-operative.

As we head into the uncharted waters of the future, I look forward to the same close co-operation that has existed between the CIPEC Council and your Department since the inception of the program.

Yours sincerely,

A handwritten signature in cursive script that reads "Jeffery Skelton".

Jeffery A. Skelton
Chairman, Task Force Council

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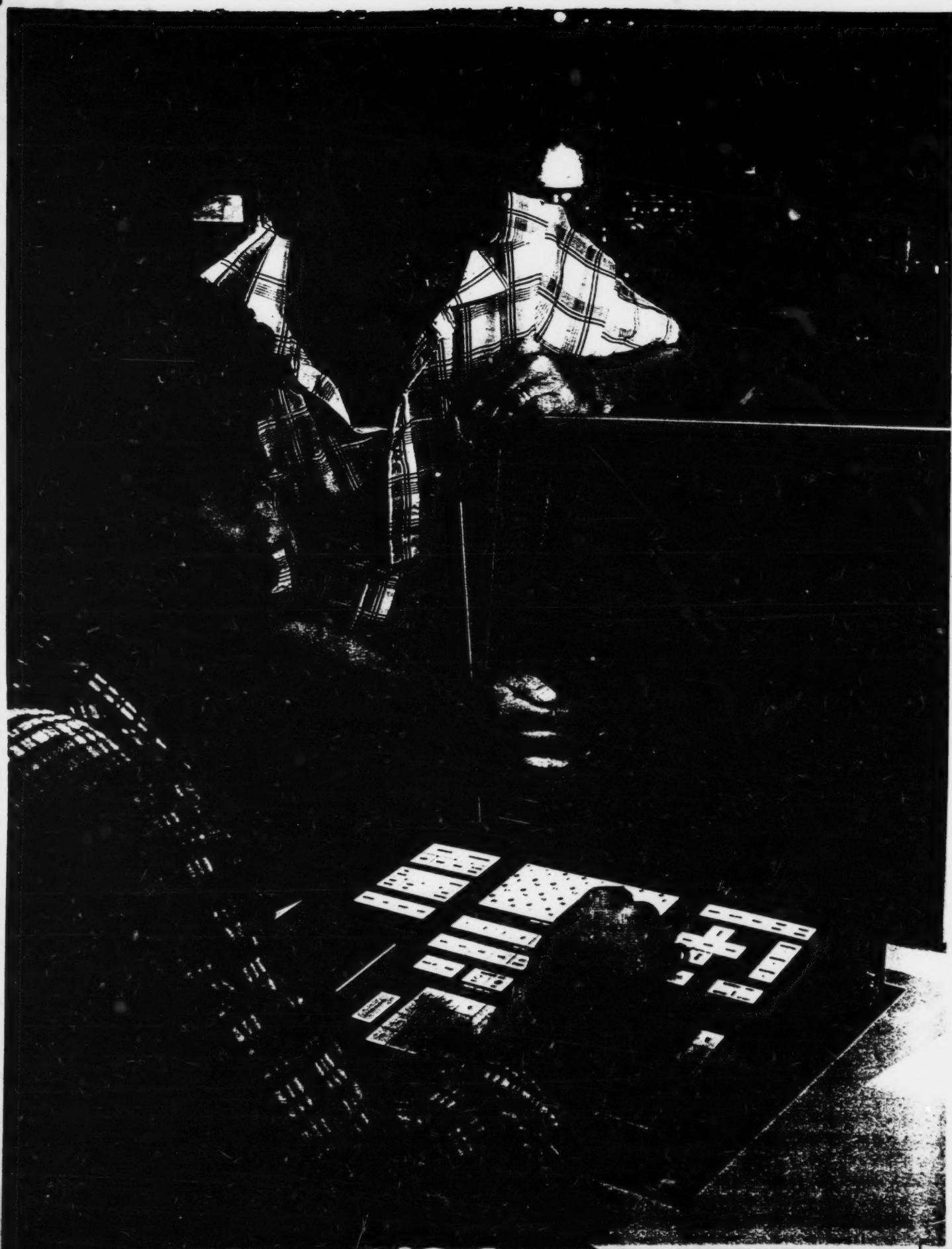
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No Time To Be Complacent

Summary

Canadian industry's energy efficiency improvement, as represented by CIPEC results, increased 1.7% in 1986, raising the total increase to 25.8% over comparable 1973 operating standards.

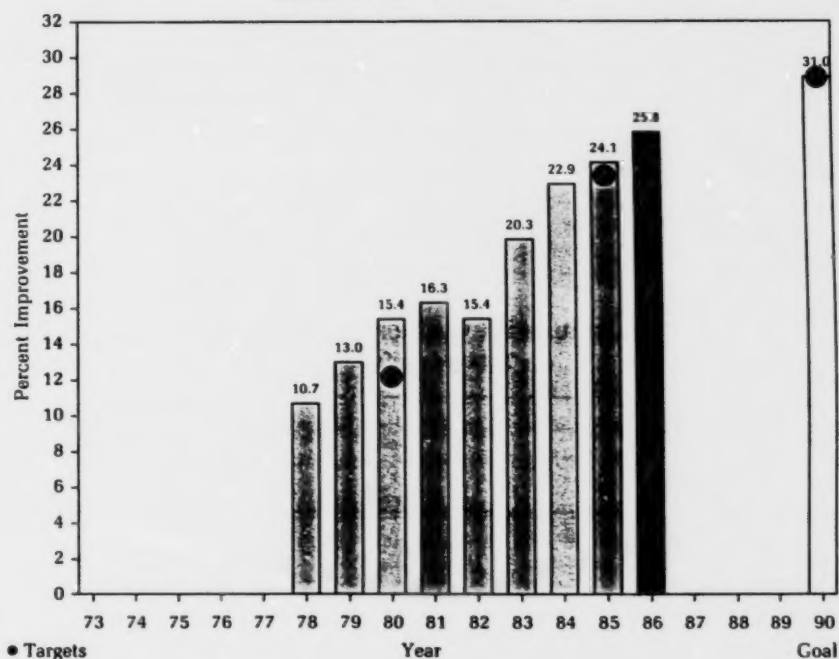
The 653 CIPEC participating companies spent an estimated \$7.97 billion for fuel and electricity during 1986, which saw the average industrial energy cost of \$5.95/gigajoule decline for the first time in over a decade. Even though collective energy improvement actions have resulted in manufacturing cost savings of about \$2.94 billion, the ratio of energy cost versus manufacturing expense continues to rise in virtually all sectors.

The trend of leading indicators affecting future improvement in energy utilization, i.e., production levels, capacity utilizations, and profits, all suggest that incremental gains now worth some \$168.5 million per year, will be much tougher to achieve. Already the 1.7% gain in 1986 is less than the average rate of 1.9% per year since the beginning of the program.

Furthermore, Canada's record of energy efficiency improvement, according to the International Energy Agency (IEA) analyses, is lagging behind the performances of other in-

Figure 1

CIPEC Energy Efficiency Aggregate Base Year = 1973



Source: CIPEC Reports

dustrialized OECD members. It would therefore appear that this is not the time for Canadian industry to be complacent.

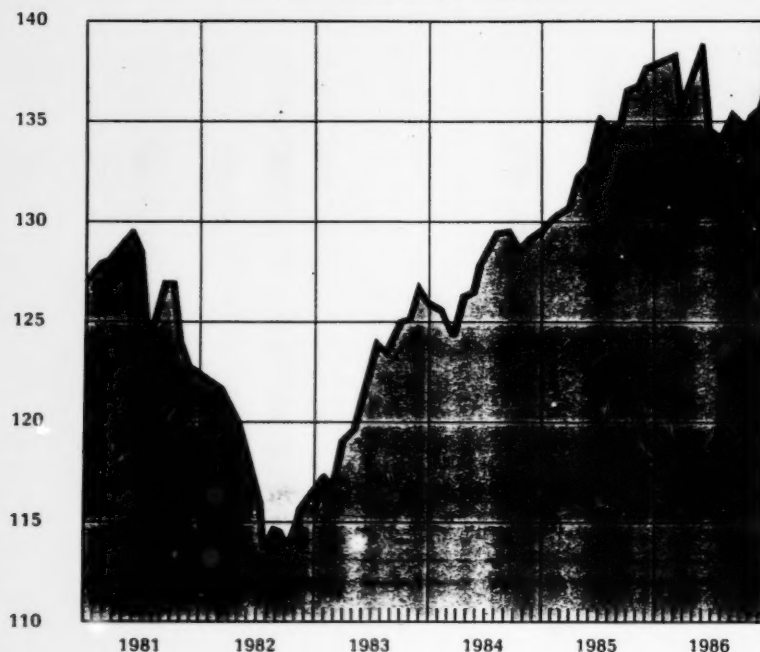
Overview

The progress of energy efficiency gains in CIPEC member companies is shown in Figure 1. The 1.7% con-

solidated increase during 1986 is slightly less than the 1.9% annualized long-term rate which includes the performance setback caused by the 1982 recession. Whereas previous efficiency gains came from a very broad base of sources, 1986 progress seems to have narrowed somewhat to fewer one-time improvements in processes and major plant equipment.

Figure 2

Industrial Production Index (Goods Producing Industries)



Source: Statistics Canada Cat. 61-005

In the early stages of the program an average gain of slightly more than 2.3% per year was achieved mainly on the strength of a multitude of low-cost "housekeeping" actions. The post-recession average improvement of 2.9% per year was supported by rapid recovery in production levels and capacity utilizations, together with accelerated rationalization strategies and strong emphasis on higher productivity standards.

This year, a combination of continued housekeeping actions and process improvements was predominant. Process improvements include such items as installation of new pressurized distillation technologies and oxygen enrichment of combustion processes. Industry is showing a growing interest in the benefits of variable speed electric drives on major pumps and fans. These types of actions suggest that a few progressive companies are well into the advanced stages of energy management.

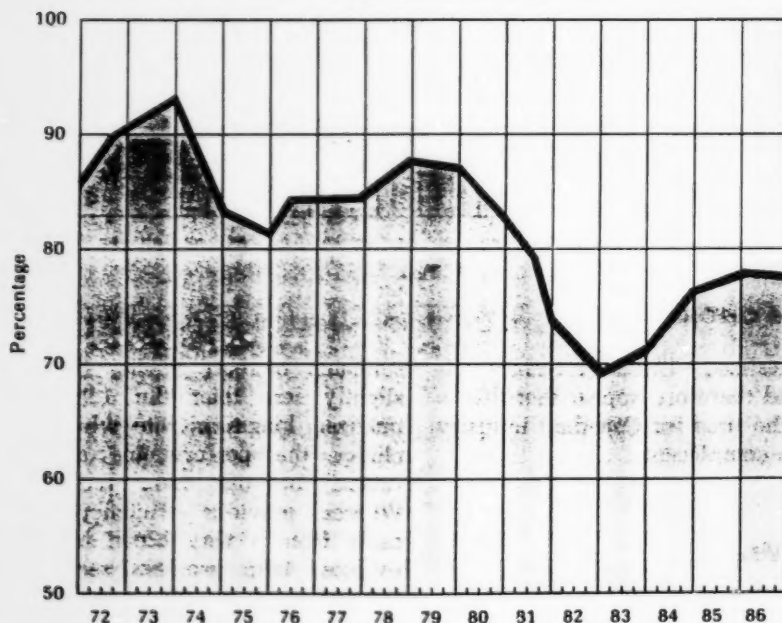
There were few, if any, indications of large scale investments or research and development projects undertaken for the sole purpose of energy conservation. Energy saving retrofits continue to be made for the purpose of minimizing expenses, but if they were made in conjunction with general productivity improvement projects, so much the better. Where stand-alone retrofits were implemented, they were usually at locations of high-grade energy conversion, e.g., burners, heat exchangers, etc., which generally provide one to three year paybacks.

In 1986, many companies were quick to take advantage of cost savings available from deregulated natural gas contracts.

Operating budgets, generally, continue to be tight and engineering staffing leaner than ever. The priority of energy management programs, often now considered vital components of general productivity programs, slipped a notch during 1986

Figure 3

Industrial Capacity Utilization Total Manufacturing



Source: Statistics Canada Cat. 31-003

because of lower energy prices. This situation is expected to reverse as energy prices resume their escalatory spiral.

Production and Capacity Utilizations

The volume of industrial production, as shown in Figure 2, oscillated through 1986, unlike the steady upward trend experienced over the past three years. It appears, therefore, the 1986 energy efficiency performance was not augmented by any general increase in output or improvement in the capacity utilization rate, as shown in Figure 3.

Capacity utilization levels¹ have an effect on energy efficiency because equipment and factories are designed to operate progressively better as output levels rise above two-thirds of their normal design capacity. This phenomenon was particularly noticeable during 1982 when CIPEC performance dipped at the same time manufacturing's capacity utilization dropped from 80% to 68%.

At the end of 1986, total manufacturing capacity utilization (Table I) declined and any major increase appears unlikely in the near future. Continued rationalization of marginally efficient operations seems to be the only way to raise capacity utilization levels and benefit from this factor.

Profits

The relationship between industry after-tax profits and CIPEC performance (Figure 4) exists partly because of the linkage between profits

¹ To help place the CIPEC performance into a total perspective, it is necessary to draw on the data from Statistics Canada and other similar information sources. CIPEC follows the Statistics Canada method for determination of capacity utilization. This approach is based on quarterly evaluation of the capital-output ratio of each industry. Factored into these statistics are allowances for technological upgrading and normal equipment replacement.

Table I

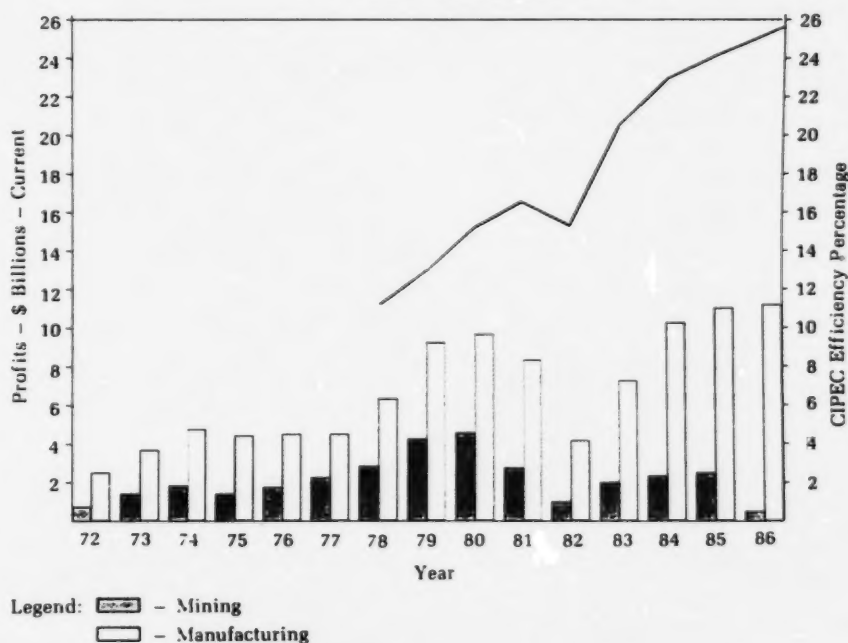
Capacity Utilizations

Sector	4thQ 1985	4thQ 1986
Chemicals	62.8	59.8
Electrical and Electronic	74.5	73.6
Ferrous Metals	74.8	75.7
Food and Beverage	80.2	78.8
General Manufacturing	83.2	79.6
Industrial Minerals	78.3	83.1
Machinery	65.5	61.6
Mining and Metallurgy	84.3	80.2
Petroleum Refining	64.3	66.1
Plastics Processing	97.7	95.9
Pulp and Paper	84.2	85.6
Textiles	87.2	87.6
Transportation (Manufacturing)	72.4	60.3
Wood Products (Western)	81.2	79.9
Durable Goods Industries	75.5	71.8
Non-Durable Goods Industries	81.6	81.3
Total Manufacturing Industries	78.4	76.3

Source: CANSIM - Statistics Canada Cat. 31-003

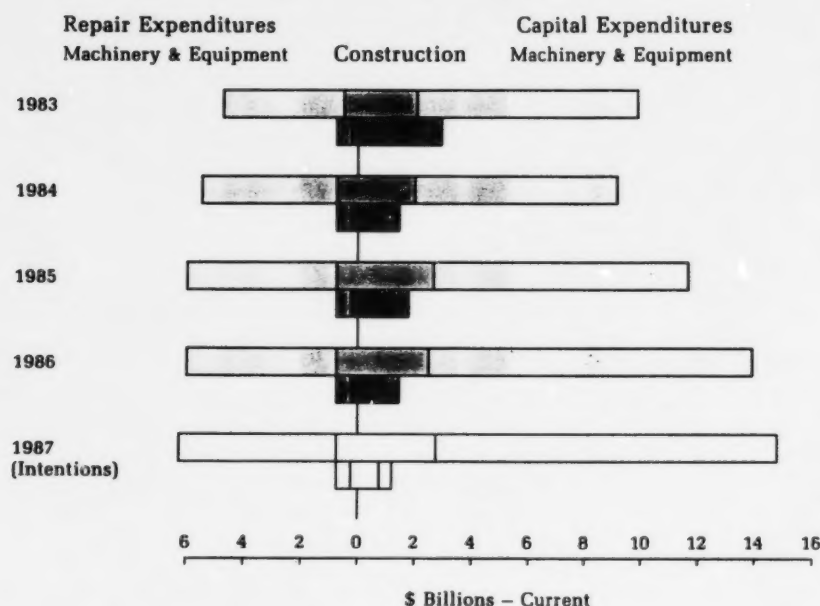
Figure 4

Manufacturing and Mining Profits (after tax) With CIPEC Performance



Source: Statistics Canada Cat. 13-001, CIPEC Reports

Figure 5
Manufacturing and Mining Investment



Legend: - Manufacturing
 - Mining

Source: Statistics Canada Cat. 61-205

and investment in new and replacement machinery and equipment (M&E).

While profits in the manufacturing sector were recovering from the 1982 recession, investment in capital M&E was also rising, as shown in Figure 5, by 29% in 1986 (to \$11.49 billion from \$8.9 billion in 1985) and 66% over the 1983 investment level. Investments in the mining industry declined 12% during 1986 (to \$595 million from \$672.5 million) no doubt because of its depressed profit picture. With profit increases slowing in the manufacturing sector and relatively low in the mining industry, it remains to be seen whether the 1987 investment intentions will be forthcoming to support energy efficiency improvements as in the past three years.

Meanwhile, expenditures in the repair category, which often include provisions for "housekeeping" energy saving actions, have been quite consistent at 3.7% of asset book value in the manufacturing sector, and 2.7% in the mining sector.

Table II

Average Energy Prices - \$/GJ (current)

Year	Composite Price	Fuel Oil	Electricity			Natural Gas		
			high (Nfld.)	low (Man.)	Canada	high (Que.)	low (Alta.)	Canada
1975	1.66	2.10	3.83	2.77	2.84	1.15	0.34	0.75
1976	2.03	2.43	4.69	3.38	3.48	1.61	0.53	1.10
1977	2.46	2.82	5.69	4.10	4.22	1.85	0.72	1.29
1978	2.81	3.20	6.50	4.69	4.83	2.15	0.96	1.53
1979	3.13	3.61	7.50	5.52	5.58	2.28	0.96	1.63
1980	3.44	4.33	8.19	5.58	6.36	2.63	1.31	1.93
1981	4.47	6.18	9.11	5.58	7.16	3.30	1.88	2.58
1982	5.35	7.71	10.94	5.66	8.11	4.32	1.90	3.06
1983	5.77	8.53	11.58	6.05	8.77	4.62	2.12	3.36
1984	6.09	9.10	12.05	6.55	9.16	4.94	2.01	3.38
1985	6.41	9.82	15.58	6.91	9.52	4.62	2.09	3.36
1986	5.95	7.82	15.72	7.00	10.16	4.65	2.09	3.31

Source: Energy, Mines and Resources Statistics Handbook based on Statistics Canada Cat. 62-001 data.

Housekeeping savings are thus likely to remain the backbone of energy efficiency savings for many years.

Energy Prices

Composite energy prices (Table II) declined for the first time since 1973 because of lower fuel oil and natural gas prices. This decline in energy prices, perhaps more than any other factor, has affected the priority of energy conservation programs.

Average wholesale prices of natural gas started to decline midway through 1985 when the federal Government removed its Canadian Ownership Special (tax) Charge. Further price reductions through 1986 were attributed to deregulation policies. There remains considerable variation in average regional prices to industry, with Quebec (\$.173/m³) at the high end and Alberta (\$.078/m³) enjoying the lowest price. The Ontario average price was \$.152/m³ in 1986.

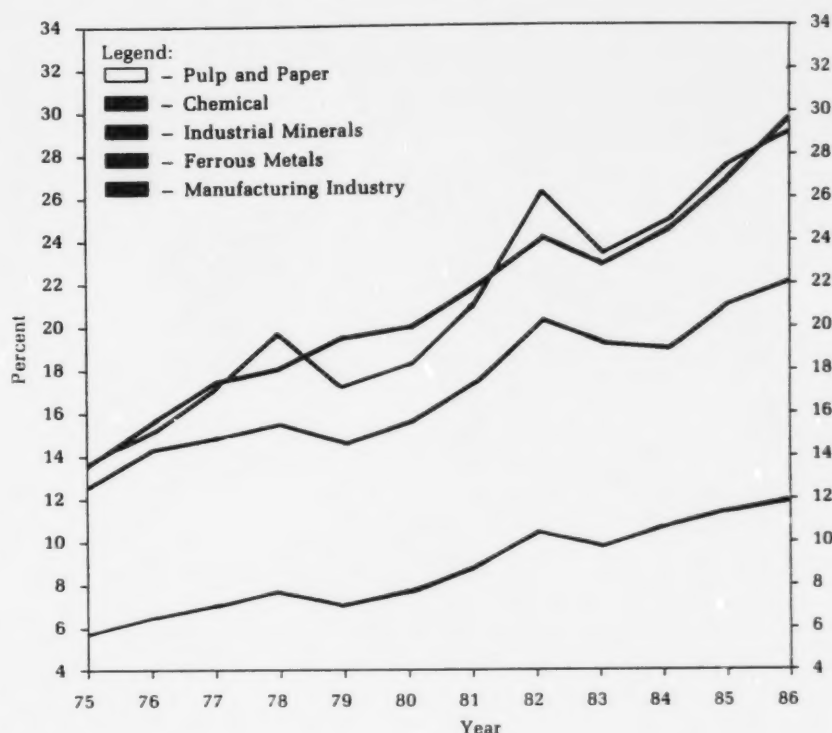
Electricity prices also vary from province to province due to different methods of generation, tax structures, extent of surpluses, and regional government policies. For instance, in Quebec and British Columbia, where electricity is generated mainly from hydro sources, the 1986 average industrial prices were \$.0308/kWh and \$.0315/kWh respectively. In the Atlantic provinces where much of the electricity is generated from oil, Nova Scotian industry paid an average of \$.0468/kWh. In Ontario, where about 60% of the electricity is nuclear generated, average price was \$.0413/kWh.

Energy Versus Manufacturing Expenses

In spite of the dip in natural gas and fuel oil prices, the cost of energy versus manufacturing expense ratio continues to climb in nearly all industries. In previous years these ratios were based on the Value of

Figure 6

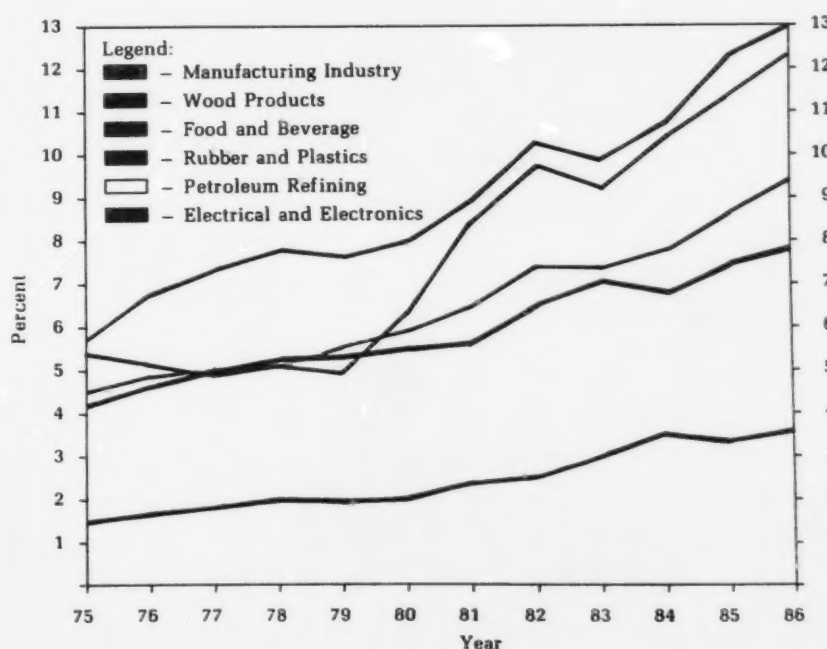
Energy Cost vs. Sector GDP



Source: CANSIM - Statistics Canada

Figure 7

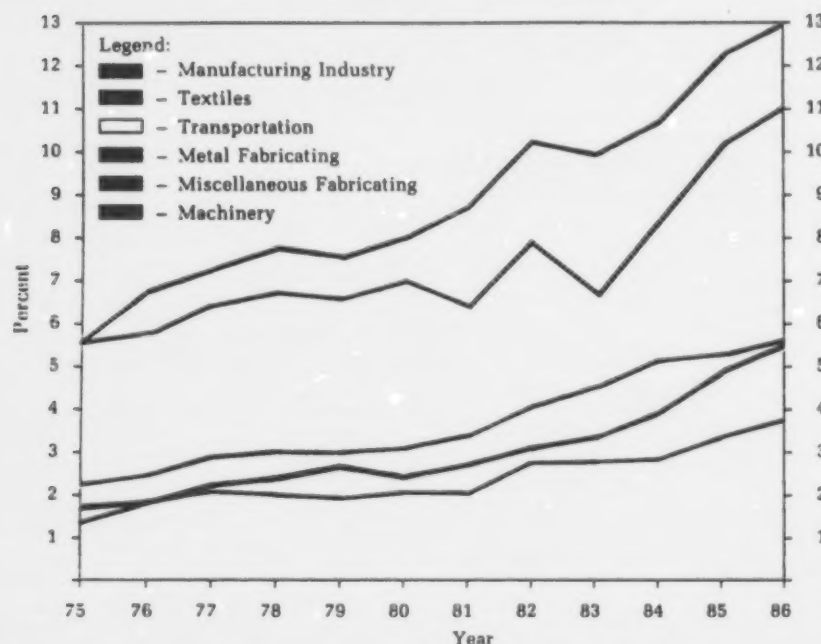
Energy Cost vs. Sector GDP



Source: CANSIM - Statistics Canada

Figure 8

Energy Cost vs. Sector GDP



Source: CANSIM - Statistics Canada

Shipments², but these data were always two years out of date and current trends could therefore not be shown. Beginning this year, cost trends will be compared with readily available GDP values. The trends shown in Figures 6, 7, and 8 are remarkably similar to those previously plotted on a Value of Shipment basis and demonstrate that regardless of the different basis of comparison, the impact is much the same.

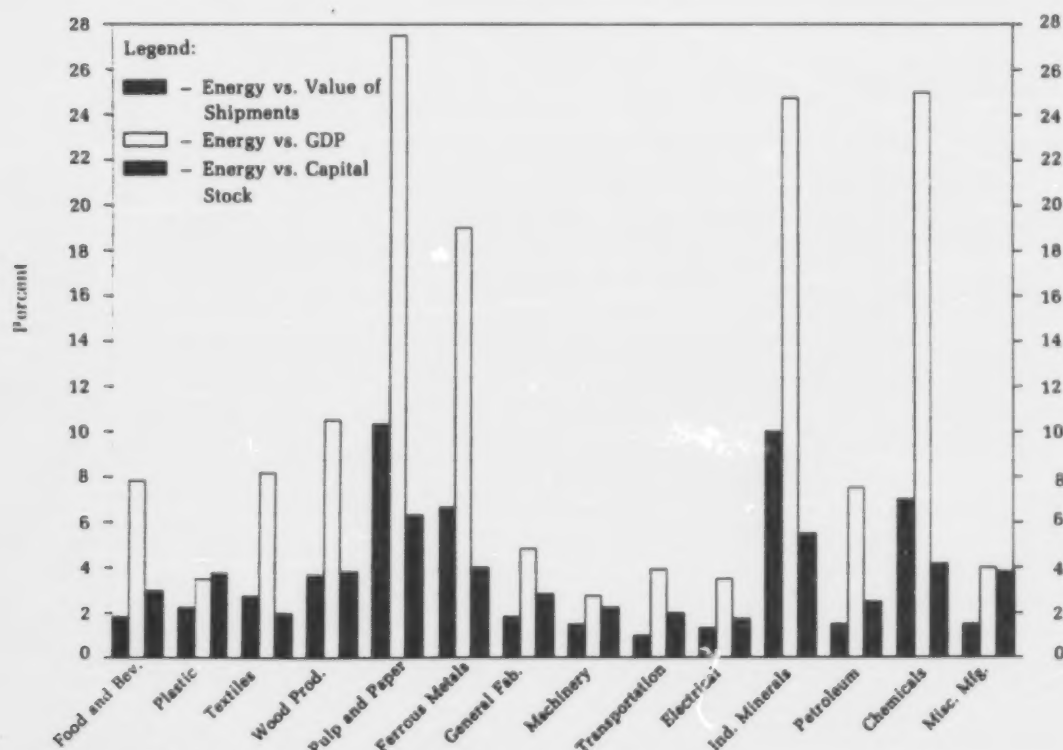
The Petroleum Refining sector is the only industry that has seen a reduction in combined energy costs and a lowered cost versus manufacturing expense ratio. In other industries, the impact of lower natural gas costs has not yet been sufficient — or has been absorbed by other price increases — with the result that energy versus manufacturing cost ratios are still rising.

² Value of Shipments of goods of own manufacture is an establishment's net selling value of the goods made from its own materials.

Figure 9

Sector Energy Intensities

1984 Data



Source: Statistics Canada Cat. 31-203, 31-003, 15-001, 61-005

Energy Intensities

While energy management decisions continue to be influenced mainly by the energy vs. manufacturing expense ratios (Figure 9), more companies are beginning to monitor additional energy intensity relationships. Energy cost vs. profits (Figure 10) is one of these key ratios. The most recent year that composite figures are available is 1984.

Since energy is one of the few remaining manageable cost items, it is increasingly viewed as a means to improve profit margins and competitiveness. Even in industries where the fuel and electrical costs are "only" in the 20% to 60% after-tax profit range, there appears to be strong motivation to improve energy productivity because of the very intense struggle to maintain profit margins.

Weather

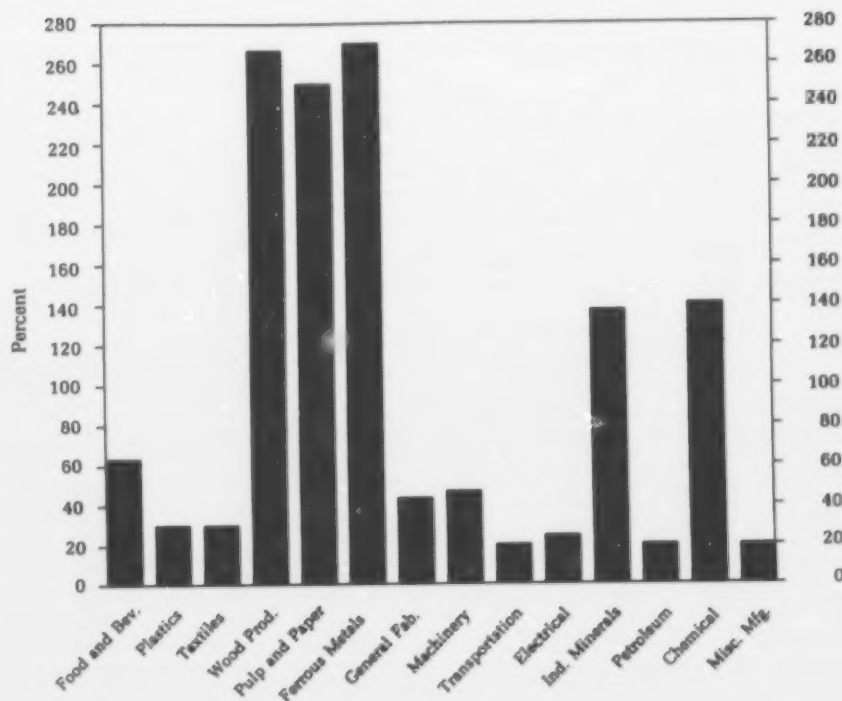
Weather had only a minor effect on energy utilization in 1986 for the bulk of industries located in central Canada. Less heating was required by companies located in the western provinces, while companies in the Atlantic provinces reported some additional energy use. Table III shows the extent of variations which many companies accounted for in their efficiency monitoring systems.

International Performance Comparison

Since Canada is a member of the Organization for Economic Co-operation and Development (OECD) group of countries, its energy utilization is constantly monitored and compared with other major industrialized countries. This international monitoring provides an opportunity to make some general performance comparisons, recognizing, of course, that there are major differences in economies and sometimes flaws in the treatment of data coming from various sources.

Figure 10

Energy Cost vs. Net Profit (after tax) 1984 Data



Source: CANSIM - Statistics Canada

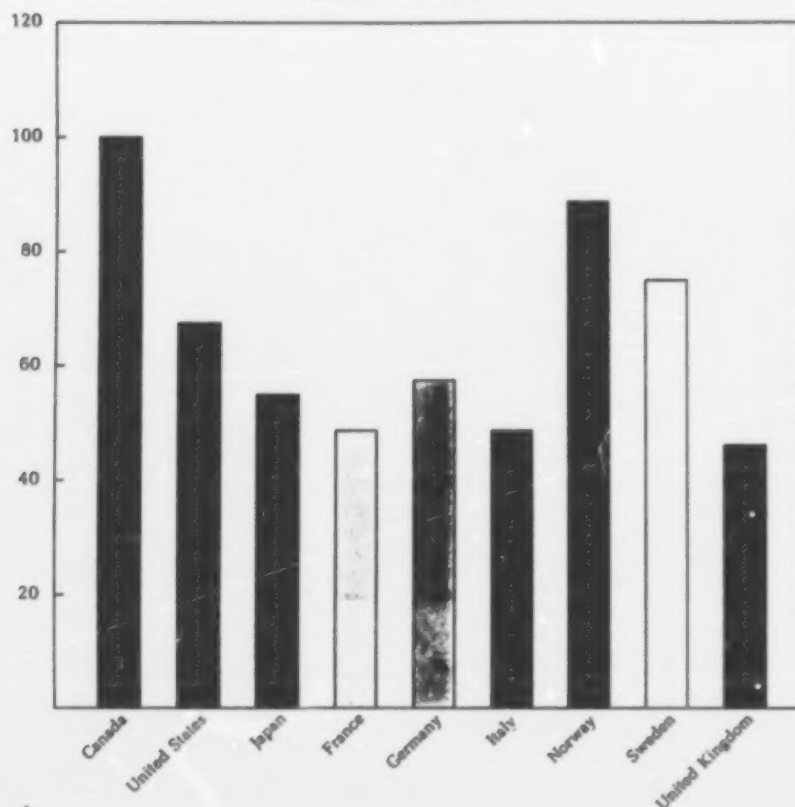
Table III

Total Heating Degree-Days (°C below 18°C)

City	Prov.	1986	1985	Normal	86 vs 85 %
Vancouver	B.C.	1173	1487	1234	-21
Calgary	Alta.	2107	2491	2181	-15
Edmonton	Alta.	2177	2502	2288	-13
Regina	Sask.	2356	2745	2399	-14
Winnipeg	Man.	2321	2683	2247	-13
London	Ont.	1515	1495	1499	+1
Ottawa	Ont.	1777	1767	1746	0
Sudbury	Ont.	2084	2131	2057	-2
Toronto	Ont.	1529	1506	1486	+1
Montreal	Que.	1740	1695	1637	+3
Quebec City	Que.	2094	1953	1910	+7
Sherbrooke	Que.	2049	1969	2028	+4
Fredricton	N.B.	2021	1915	1763	+6
Halifax	N.S.	1633	1537	1415	+6
Charlottetown	P.E.I.	1895	1743	1608	+9
St. John's	Nfld.	2087	1943	1765	+7

Source: Environment Canada

Figure 11
Industrial Energy Consumption/GDP Ratios – 1985
 (Canada = 100)



Source: IEA, OECD, Ontario Ministry of Energy

The fact that Canada is one of the highest per capita energy consumers is not the issue here since consumption rates merely reflect the characteristics of each country's industrial base, economy, population density, mix of energy sources, and climate. Whether certain per capita consumption rates are high or low does not necessarily imply that one country is more or less wasteful than another.

What is most important to Canadian industry is the rate at which industrial energy efficiency improvements are being made.

The International Energy Agency (IEA) studies measure energy consumption as a percentage of GDP.

But a recent study³ on this subject has taken a closer look at the various differences in OECD economies to determine how Canadian industry compares with its competitors.

Through refinement of Total Final Consumption (TFC) figures and the various GDP denominators — using new Purchasing Power Parity (PPP) values — a clearer picture emerges that reveals the differences in OECD countries' performances. For example, the Ontario study applies true conversion factors to each different source of energy and accounts for a larger portion of huge transmission losses in Canada. Purchasing Power Parities is a new method of normalizing the value of currencies that avoids, to a great extent, distortions

caused by the use of simple exchange rates.

In general, the industrial energy-intensities of other OECD countries tend to be about 40% lower than Canada's (Figure 11). Norway's industry energy-intensity was about 12% below Canada's, while France, Italy, and the United Kingdom had energy-intensities half Canada's rate. American industrial energy-intensity is about 35% below Canada's. These 1985 results are the latest figures available and show industry's total utilization of fuels and electricity, including feedstocks (non-energy use).

More importantly, the studies show that Canadian industry's rate of performance improvement of 13% over the past 12 years lagged behind all other industrialized OECD countries (Figure 12). (The CIPEC efficiency gain of 24.1% between 1973 and 1985 is calculated on a different basis, i.e., energy consumption per physical unit of output, and is therefore not directly comparable).

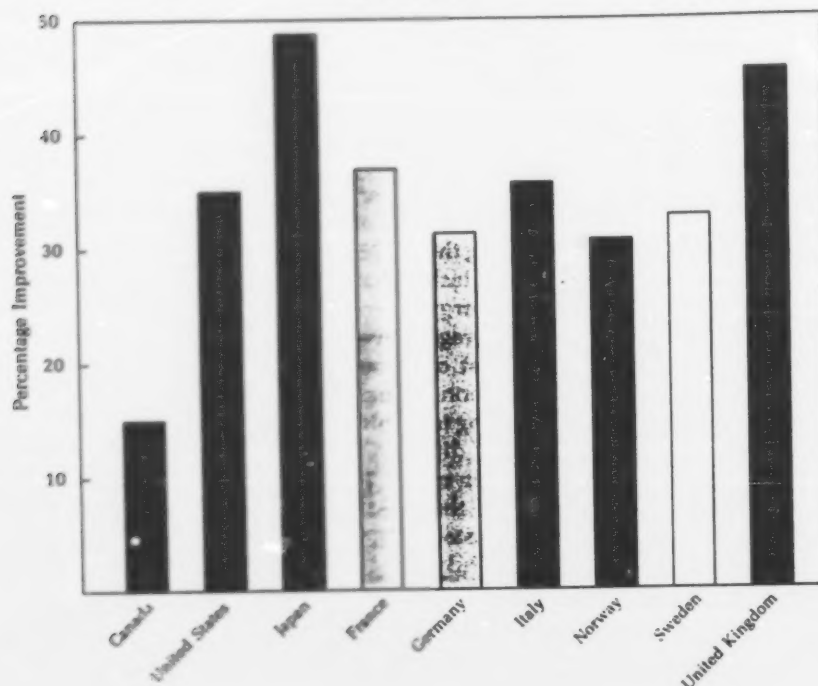
Two of the major reasons for faster energy efficiency improvement in Europe and Japan in recent years were no doubt due to the market-sensitive path of energy prices and the greater threat of supply interruptions. Different government policies, tax structures, and business strategies also affected performance.

The study further shows that the energy conservation improvements of most countries have slowed since 1982. It was suggested that declining real energy prices were a significant factor and that additional improvements are progressively harder to achieve.

Many of Canada's competitors continue to shift to higher value-added manufacturing, which tends

³ S. Rive, (Ontario Ministry of Energy). "International Comparison of Energy Use." Conference Paper, July 8, 1987.

Figure 12
Improvements in Industrial Energy Intensity
1973 - 1985



Source: IEA, OECD, Ontario Ministry of Energy

to require less energy per unit of output. But Canada's resource based, highly energy-intensive economy will probably continue to experience relatively slower rates of performance increase.

Government Participation in CIPEC

From its beginning in 1975, CIPEC has remained an exemplary program in which co-operative actions by industry and government have worked toward a common objective.

Industry remains committed to the program because it is a good source of technical information, and an opportunity to directly communicate its needs and progress to government. What's more, candid comments from company management suggest that they might not have maintained their energy conservation programs had it not been for the continuance of CIPEC.

For its part, government has indicated that it values the program, not only because of the low-cost national benefits that result from co-operative efforts, but also because of the opportunity to plan and co-ordinate its actions with the full knowledge of the participants. Much of this dialogue occurs at the CIPEC Council, which is composed of task force chairmen and representatives of the Business and Government Energy Management (BGEM) Division of EMR. Additional interaction occurs at the individual task force level which often includes representatives of related trade associations.

To help achieve the 25.8% improvement in energy efficiency throughout industry, government has assisted with several incentives and grant programs. Some earlier programs have served their purpose and have since been scaled down or discontinued. These include grants

designed to encourage substitution of non-renewable sources of energy, some auditing services, and special programs structured to assist regions heavily dependent on fuel oil as an energy source.

There remain, however, a wide variety of energy conservation programs available to industry in such areas as research and development, technology transfer, demonstration projects, tax incentives, and provision for special technical and economic studies. In addition, the government also supports six voluntary task forces in the commercial, institutional and agricultural sectors which function along similar lines to those within CIPEC.

It should also be mentioned that most of the provincial governments provide complementary energy conservation programs to assist industry. Many of these are co-ordinated or co-sponsored to avoid duplication of services.

At the end of 1986, the federal Government's original National Energy Policy of 1980 was no longer in effect. In its place, steps were taken to initiate new cross-Canada dialogue on the "Issues and Challenges of Canada's Multiple Energy Future". A broad range of discussions will ensue to develop a comprehensive policy based on market-driven strategies. This new policy, according to the federal Minister of Energy, Mines and Resources, will address more closely the interplay between production, conservation, technology and trade, environment and the role of energy in the economy.

These latest government initiatives are an encouraging development for industry. Without government help, industry would have a more difficult task of meeting the performance goal of 31.3% improvement by 1990 (compared with 1973 standards). Continued co-operation between industry and government is essential to achieve this goal.

Summary of Task Force Reports

This section highlights data taken from the task force reports to show trends and aggregate results in a consolidated format.

Participation in the CIPEC program during the past 11 years has been substantial in spite of profound changes in the economy. In 1986, 653 companies participated in the survey. This level of participation compares with 678 in 1985, 693 in 1984, 704 in 1983, 663 in 1982, and 683 in the pre-recession year of 1981.

While individual task force performances and CIPEC efficiency results are shown in Figure 13, a direct comparison between each industry's performance should not be made since there can be major differences in energy conservation opportunities, energy-intensities, industry concentration, etc. Even within multiple-sector industries, e.g., food and beverage, general manufacturing, industrial minerals and transportation, some caution should be exercised for the same reason.

Energy Consumption and Savings

The 1986 CIPEC total energy consumption of 1352.12 petajoules was provided by the sources shown in Table IV. When compared with the 1985 (new base year equivalent) energy consumption of 1375.34 petajoules, the efficiency of energy utilization increased 1.7%.

Compared with the original 1973 base year, the 25.8% gain in efficiency was determined from a consolidated base year equivalent energy consumption of 1822.26 petajoules. Thus, the total 470 petajoule (76.8 million barrels of oil-equivalent) savings since 1973 repre-

sents a sizeable contribution to Canada's energy conservation objective.

For the purpose of determining the total savings (Table V) for the task forces and CIPEC, the cost of energy is based on published average energy unit prices. Average cost of fuel and electricity varies among participating industries according to the proportions of energy-mix, different commodity prices, location of the reporting companies, and the amount of non-purchased "waste" fuels reported. In the case of Pulp and Paper and Wood Products, their average prices would have been much lower had the large amounts of hog-fuels and biomass waste fuels been reported. These average results are shown in Table VI for each sector.

Energy Distributions

Canadian industry continues to be blessed with abundant supplies of competitively marketed energy. This

situation, especially now that natural gas has been deregulated, often permits consumers to make fuel substitutions as prices fluctuate. In 1986, several task forces reported that companies are using computer programs to determine the cross-over points after the efficiencies of combustion, contract limits, and marginal unit prices have been taken into account.

The historical shares of the different energy sources used by the CIPEC participants are shown in Table VII. The most significant total shift has occurred in the fuel oil category which has experienced a 20.4% decline since 1975. This percentage reduction has been offset by increases in electricity (7.5%), natural gas (5.7%), coal and coke (3.1%), and other miscellaneous fuels (4.1%).

Fuel oil now supplies the smallest share of energy inputs, and because it continues to absorb all the increases from other sources its percentage drop is magnified.

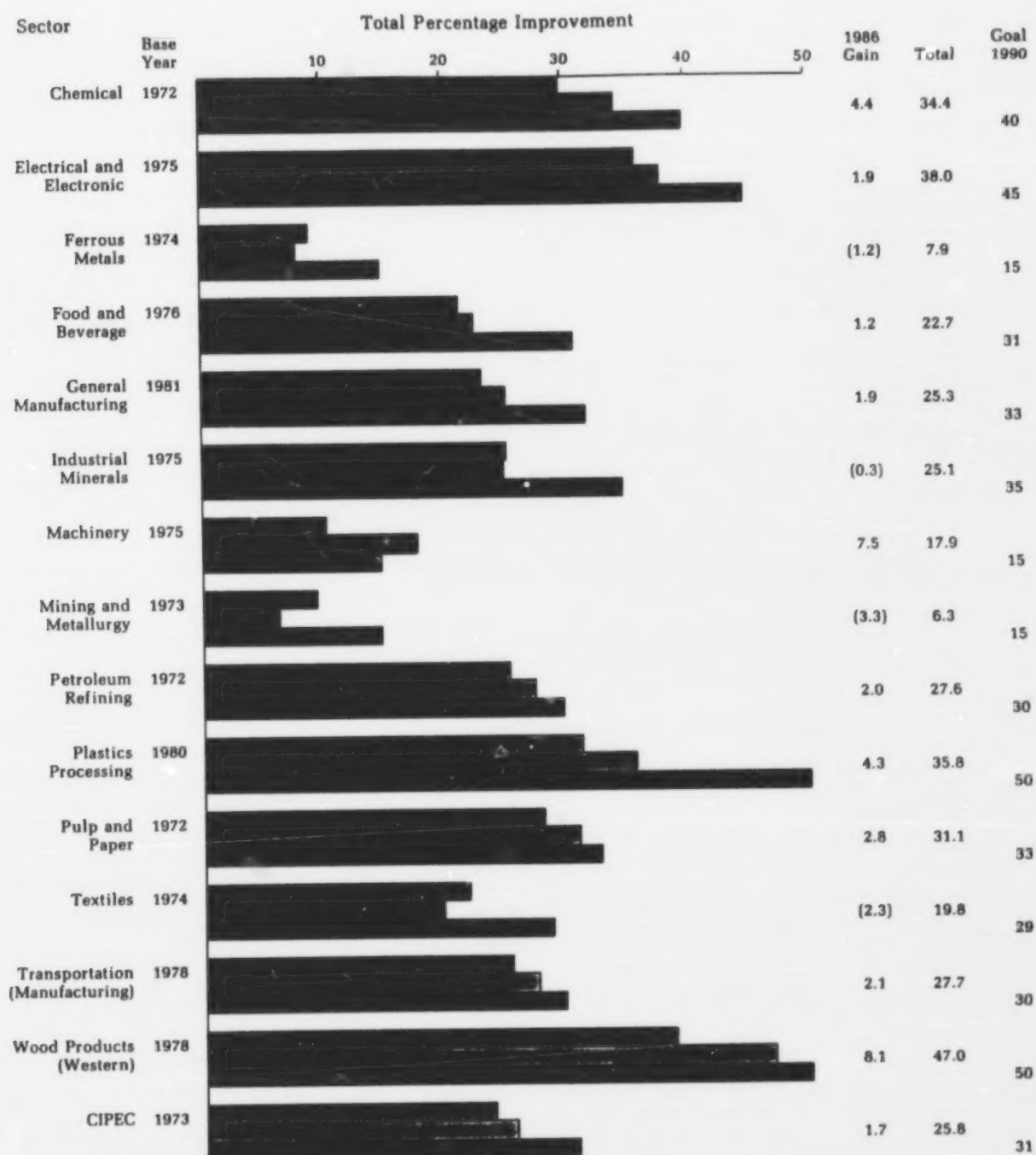
Table IV

CIPEC Energy Consumption

Type	Quantity	Petajoules
Electricity	82,881,137 MWh	298.36
Natural Gas	11,940 million m ³	445.17
#2 Oil	306,852 kilolitres	12.30
#6 Oil	3,374,534 kilolitres	138.97
Propane	283,978 kilolitres	9.17
Diesel	142,013 kilolitres	5.54
Gasoline	14,890 kilolitres	.59
Coal/Coke	9,456,890 tonnes	282.35
Steam	n/a	8.77
Others	n/a	150.90
Total		1,352.12

Figure 13

Energy Intensity Improvement



Legend: [Patterned Box] - Base Year to 1985
 [Patterned Box] - Base Year to 1986
 [Solid Black Box] - 1990 Goal

Source: CIPEC Task Force Reports

Table V

Energy Consumption, Costs, and Savings

	Energy Use (PJ)	Estimated Total Cost (\$'000)	Total Savings (\$'000)	Annualized Savings (\$'000)
Chemical ⁽¹⁾	241.25	1,402,484	761,864	37,835
Electrical and Electronic	5.80	43,977	27,006	1,575
Ferrous Metals	265.48	874,818	75,099	5,801
Food and Beverage	37.86	246,521	72,675	6,053
General Manufacturing	16.33	123,317	41,777	6,573
Industrial Minerals	82.63	421,904	141,569	10,144
Machinery	0.56	4,299	936	71
Mining and Metallurgy	89.79	732,428	49,246	3,566
Petroleum Refining ⁽¹⁾	237.77	982,618	378,838	19,926
Plastics Processing	2.94	23,014	12,850	1,461
Pulp and Paper	312.29	2,709,516	1,220,375	61,463
Textiles	11.23	82,728	20,424	1,387
Transportation (Manufacturing)	44.51	297,692	114,450	10,705
Wood Products (Western)	3.62	30,884	27,388	1,927
Total ⁽²⁾	1352.12	7,976,206	2,944,499	168,495

⁽¹⁾ All sectors' electrical conversion factors, including the Chemical and Petroleum Refining totals, are based on the standard 3600 kJ/kWh rate.

⁽²⁾ Numbers may not add due to rounding.

Source: CIPEC Task Force Reports.

Table VI

Sector Average
Energy Unit Costs

Sector	\$/GJ
Chemical	5.81
Electrical and Electronic	7.57
Ferrous Metals	3.30
Food and Beverage	6.51
General Manufacturing	7.55
Industrial Minerals	5.11
Machinery	7.61
Mining and Metallurgy	8.16
Petroleum Refining	4.13
Plastics Processing	7.81
Pulp and Paper	8.68
Textiles	7.36
Transportation (Mfg.)	6.69
Wood Products (Western)	8.53
CIPEC average	5.95

Source: CIPEC Task Force Reports.

There are minor deviations in year-to-year trends due to changes in reporting population and difficulties in reporting the amounts of waste fuels. These effects are often noticeable at the task force level of reporting, but become insignificant at the consolidated level.

Refined Petroleum Products

Actual fuel oil consumption among CIPEC participants declined 64,143 M³ (403,500 barrels) during 1986, reducing the proportion of total consumption from 17.5% to 11.6%. This decline was partly the result of residual effects of the Canada Oil Substitution Program that was terminated in 1985.

All sectors except Petroleum Refining, Ferrous Metals, and Mining and Metallurgy, experienced a de-

cline in oil share in 1986. In Petroleum Refining's case, less natural gas was used. The largest proportional 11-year drop (45%) in oil consumption occurred in the Machinery sector where three-quarters of the shift went to natural gas.

It is estimated that about one-third to one-half of the current 11% oil consumption in industry will be replaced by natural gas and electricity by the end of the decade. This should occur as a result of continued aggressive marketing by natural gas and electricity utilities plus increased application of co-combustion technologies.

Natural Gas

No significant increase in natural gas consumption was detected in 1986 following the deregulation of this commodity since most com-

panies, where possible, were already using it as their main fuel. However, significant cost savings in the order of 5% to 20% were achieved as a result of renegotiated contracts and direct purchasing.

Electricity

The share of electric power continues to gain steadily in spite of prevailing higher prices. All sectors, except Mining and Metallurgy, and Plastics Processing, registered increases. The decrease in purchased electrical power in the Mining and Metallurgy sector results from added co-generation facilities.

Major increases of 2.1% for Chemical, 2.4% for Pulp and Paper, and 6.5% for Textiles have occurred mainly in Quebec where there still exists favourable incentives, in the form of capital retrofit subsidies, to switch from fossil fuels. For instance, several large electric-

powered steam boilers are still being installed as a result of Hydro-Quebec's incentive program. In addition, a major chemical company replaced two huge oil-fired steam turbines with two 17-megawatt variable-speed electric drives to gain the operating cost benefits which will yield a payback of less than two years.

The general shift to greater use of electric power also reflects increased factory automation and use of electricity for such purposes as induction and/or direct process heating.

Coal and Coke

The coal and coke net gain of 1.7% was due to a significant increase in the Industrial Minerals sector where robust construction activities drove cement making plants to top capacities. Greater use of domestic low-sulphur coal in central and east-

ern Canadian cement manufacturing plants might become more economic, however, if transportation costs are lowered through current federal Government initiatives. As an alternative, cement manufacturers are looking to Refuse Derived Fuels (RDF) as possible substitutes.

Others

The category of "other" fuels is a diverse mixture of wastes, process by-products, and miscellaneous fuels that are reported mainly by the Chemical and Petroleum Refining sectors. The Pulp and Paper industry also uses as fuel a huge amount of waste hog-fuel and pulping liquor that is not included in this category. Large quantities of hog-fuels are also used by the Wood Products sector. In these latter two sectors, it is considerably more difficult to account for the quantities used and therefore they have always been excluded from the trend analysis.

Table VII

Distribution of Energy Consumption

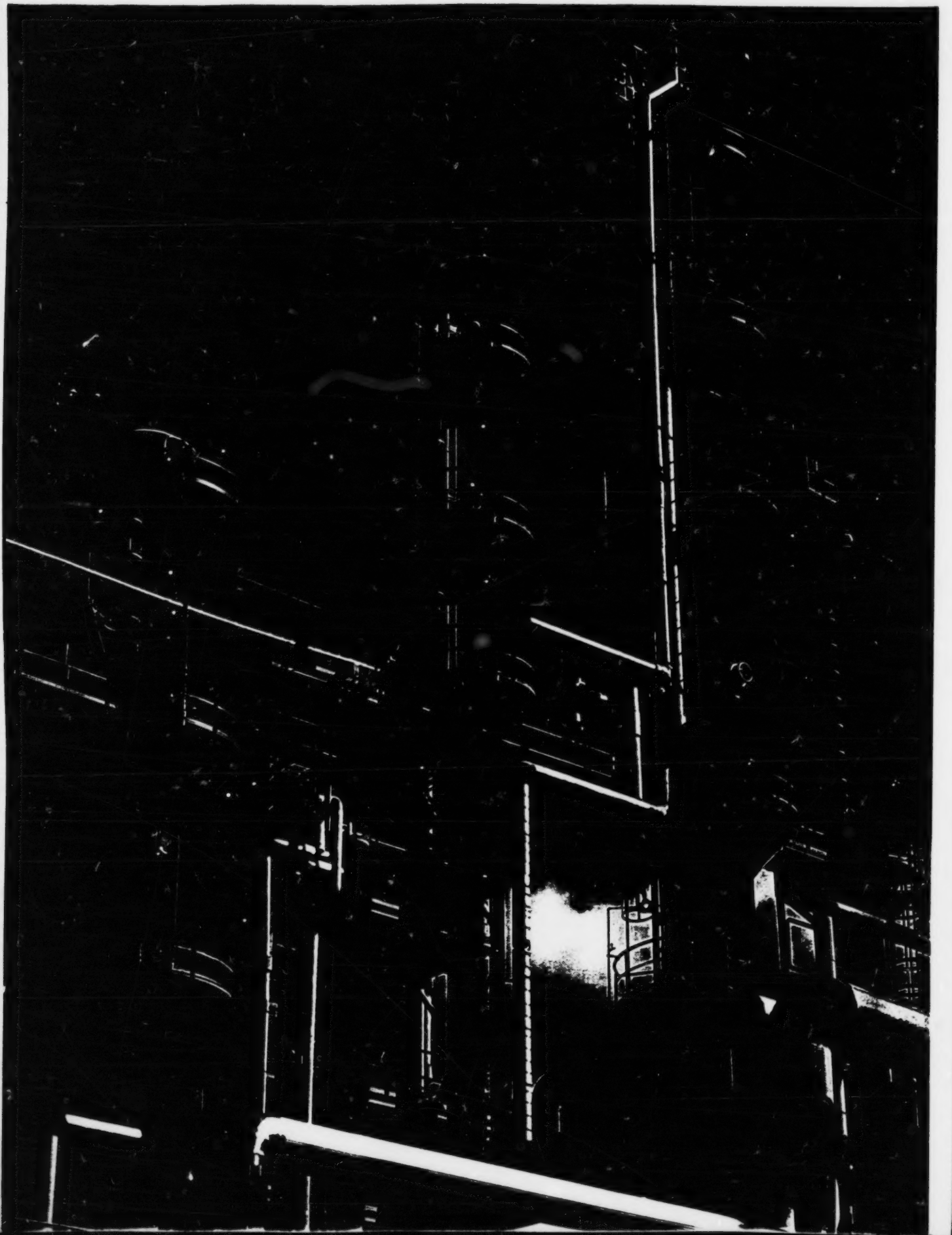
	Nat. Gas and Propane				Liquid Petroleum Products				Electricity ⁽¹⁾				Coal and Coke				Others ⁽²⁾			
	86	85	80	75	86	85	80	75	86	85	80	75	86	85	80	75	86	85	80	75
Chemicals	61.1	62.6	54.4	57.1	3.7	5.8	15.3	24.3	13.3	11.2	24.2	17.0	0.6	0.1	2.3	-	21.2	20.3	4.0	1.3
Electrical	57.6	59.6	57.3	48.0	3.4	5.4	9.6	24.4	37.5	33.5	31.5	27.8	-	-	-	-	1.4	1.5	-	0.2
Ferrous Metals	19.7	19.4	18.9	15.4	4.5	4.2	10.5	13.2	7.6	7.3	5.9	5.4	68.1	69.1	64.6	68.8	-	-	-	0.3
Food and Bev.	69.5	69.7	64.8	48.5	10.7	11.7	20.6	38.5	19.4	18.6	14.6	12.5	-	-	-	-	0.3	-	-	0.2
General Mfg.	53.9	60.2	52.9	n/a	10.4	11.6	21.0	n/a	35.3	28.1	26.1	n/a	-	-	-	-	0.4	0.1	-	n/a
Ind. Minerals	40.4	42.6	43.1	50.6	6.8	9.3	26.1	33.1	15.7	15.6	15.8	10.3	36.6	32.4	14.3	5.8	0.4	0.1	0.1	0.1
Machinery	57.6	55.5	41.1	22.1	6.5	13.3	30.3	51.4	35.9	31.2	24.7	23.6	-	-	-	-	-	-	1.3	-
Mining	23.5	25.2	18.6	12.4	24.3	23.5	36.5	48.0	40.2	41.2	39.5	35.1	11.9	9.9	4.5	4.4	0.2	0.2	0.5	-
Petroleum	19.3	24.3	12.9	12.5	9.8	6.7	23.7	22.9	5.5	4.6	3.6	3.5	20.7	19.6	15.1	16.7	44.7	44.7	44.7	44.4
Plastics Proc.	53.4	51.4	63.5	43.5	4.2	5.4	3.1	31.9	42.5	43.2	33.4	23.7	-	-	-	-	-	-	-	-
Pulp and Paper	26.1	26.1	25.5	18.3	24.0	25.8	41.3	52.7	47.3	44.9	29.1	24.9	1.8	2.9	3.0	3.6	0.5	0.3	1.0	0.7
Textiles	47.9	41.8	23.3	29.0	24.0	36.7	53.0	49.9	28.0	21.5	22.0	20.1	-	-	-	-	0.1	-	1.7	0.9
Transport (Mfg.)	55.8	54.6	49.1	42.1	3.5	3.7	16.2	31.0	30.7	30.1	23.6	23.0	9.5	11.0	11.1	3.1	0.2	0.6	-	0.4
Wood Products	44.0	52.0	45.3	n/a	-	-	11.1	n/a	56.0	48.0	43.6	n/a	-	-	-	-	-	-	-	-
Totals	33.6	32.3	31.0	27.9	11.6	17.5	24.0	32.0	22.1	19.1	18.5	14.6	20.9	19.2	17.1	17.8	11.8	11.8	9.1	7.7

Footnotes:

(1) All sectors' electricity converted at 3600 kJ/kWh.

(2) Other fuels include purchased steam, plant wastes, process by-products, miscellaneous fuels, but excludes wood wastes used in the Pulp and Paper and Wood Products sectors.

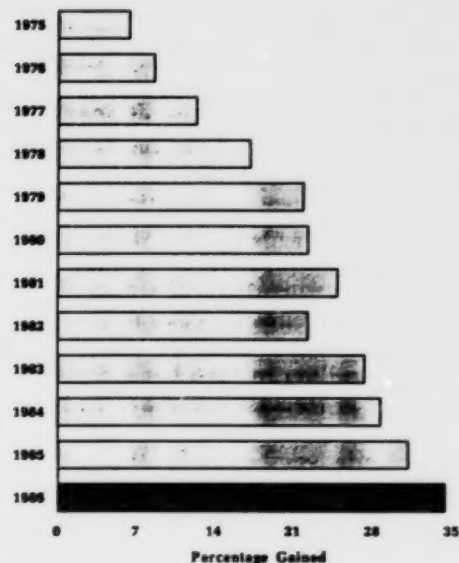
Source: CIPEC Task Force Reports.



Chemical Industry

Energy Conservation Task Force

Dr. David Shearing
Chairman



Task Force Description

Energy usage and conservation data for the chemical industry are based on an annual survey of member companies of The Canadian Chemical Producers' Association (CCPA). These companies produce a broad range of manufactured chemicals for domestic and export markets. Plant sizes vary from very large world-scale integrated facilities to smaller units that produce for more limited markets.

The 53 participants represented in this report spent an estimated \$686 million for fuel and another \$368 million for electricity during 1986. The cost of feedstocks is not included in the survey because the reporting methodology treats any improvements in raw material conversion rates as total plant efficiency gains and therefore as improvements in the utilization of fuels. On the basis of the above costs, this report represents 75% of the total chemical industry.

Performance in 1986

Energy conservation activities resulted in a total improvement in energy efficiency up to 1986 of 34.4% based on the 1972 base year. Compared with the new 1985 base year, the participating companies reported an energy efficiency gain of 4.4%.

In previous surveys, the majority of energy conservation improvements reported were activities that focused on combustion and steam distribution systems. Even though a few companies still mentioned basic utility system improvements, the nature of these comments suggests that most companies now consider these actions to be basic to good energy management. Partly as a result of the new deregulated natural gas contracts which penalize excessive consumption, more attention is being given to increased fuel switching to minimize total operating costs. Many companies are having to upgrade their computerized control

systems to provide consistent monitoring of these efficiencies. Another indication that companies are starting to look beyond the common techniques, such as preheating combustion air, comes from references to oxygen-enrichment projects.

However, in 1986 not all companies reported specific energy-saving projects. This is not surprising since it was a year of some disappointment in certain businesses, particularly where end-products serve agricultural and basic resource industry customers. In these cases, the opportunities presented by extended shutdowns were used to make improvements that will help in the long run. A few older plants were temporarily or permanently retired. Naturally, these shutdowns and retirements contributed to the efficiency improvement.

Future Outlook

The jump in energy efficiency in 1986 was helped by the relatively

large investment in new machinery and equipment (M&E) during the past three years. Significant energy conservation projects often require two years to implement, plus another year for the results to show. General projects, often incorporating energy savings, usually take longer to complete. Looking back to the peak investment year of 1983, \$1308 million was spent on M&E. That investment was four times the spending on new construction and three times the expense of replacing and maintaining existing equipment. Following 1983, the annual M&E expenditures dropped to \$747 million and \$687 million. They rose to \$932 million in 1986 but a drop to \$801 is forecast for 1987. This may seriously affect the industry's rate of efficiency gains for the rest of the decade.

Case Histories of Plant Improvements

The 4.4% efficiency improvement resulted in savings of \$46 million in fuel and electricity costs during the year. This significant sum was achieved in many different ways. For example, one large petrochemical company in Quebec replaced two huge steam condensing turbine drives (which together with the auxiliary equipment supplied only 23% thermal efficiency) with two 17-megawatt variable speed electronic motor drives delivering 95% conversion efficiency. The estimated \$11 million annual saving will pay back the cost of the project in less than two years.

In another company plant, the geometry of the main process compressor rotor vanes was altered, for a modest cost of \$16,000. Efficiency was thus raised enough to offset nearly \$129,000 in natural gas fuel costs for the main power boiler. This example, while not the most expensive, was only one of 38 separate energy conservation projects completed by the company during 1986.

Over the years, this particular company, as a result of a very active energy management program, has implemented a large number of improvement projects. This program is based on continuous identification of new opportunities by plant management, well-defined performance targets and the willingness of senior management to budget for a steady rate of technological and operating improvements.

Another large petrochemical company spent \$99,000 to revise its main process compressor shaft seals and now expects to save nearly \$275,000 each year by cutting down on the normal leakage that previously had to be flared.

This year many of the participants reported that completion of major process changes has had a profound effect on their plants' overall efficiency. One polypropylene resin manufacturer, for example, successfully converted to the new Montedison-Sheripol technology which is about 50% more energy efficient than the older conventional process. The major titanium oxide producers have recently installed additional high-efficiency process filters to enhance energy recovery rates. A few companies reported that their distillation equipment was upgraded after analysis of the designs by the new computerized simulation software programs that are now available. Others reported that the addition of new cogenerating equipment has provided very large gains in efficiency.

Energy Consumption Patterns

In the tables shown, the proportions of energy used in 1986 are compared with the 1981 distribution to illustrate not only the extent of the shifts, but also the general trends that will most likely continue into the future. The minor changes in product-mix and reporting population are not significant enough to distort the basis for this comparative analysis.

The 8.5% gain in the natural gas share has been mainly at the expense of a decrease of 5.5% in the fuel oil category. Over the 5-year time span, the rate of substitution has slowed because of lower oil prices which prompted many companies with dual fuel firing capabilities to switch back temporarily to take advantage of lower fuel prices. The minor gain in combustion efficiency with natural gas is usually ignored when decisions are made as to which fuels to use.

The decreased electrical share (2.9%) is partly the result of faster growth of other types of energy plus the effects of increased cogeneration in plants (where the reporting methodology accounts for purchased electricity at 10,551 kJ/kWh while 3600 kJ/kWh applies to self-generated power). In addition, it is often easier to make permanent energy conservation improvements in electrical systems, e.g., installation of high efficiency motors and equipment to maintain high power factors, whereas with fuel systems the improvement can diminish over time if not maintained.

The category of by-products is a complex assortment of plant wastes or by-products that provide worthwhile fuels at little or no cost to the companies involved. Recovery of flare gases for consumption in process boilers and heaters is a common source of non-purchased fuels. Where some of the process by-products were burned as fuel, e.g., hydrogen from chlorine cells, surveys now suggest that more effort is being made to clean and/or liquefy some of these commodities for resale. The trend to increased use of these fuels will continue as more companies develop the environmental capabilities to burn exotic mixtures safely.

Chemical Industry
Energy Efficiency Improvement

Current year (1986) total energy inputs	303.280 petajoules
New base year (1985) equivalent energy inputs	316.320 petajoules
Gross Improvement = 4.1%	
Adjustments	0.775 petajoules
Adjusted base year equivalent	317.095 petajoules
Net Improvement =	4.4%
Efficiency gain 1972 - 1985	<u>30.0%</u>
Total gain 1972 - 1986	<u>34.4%</u>

Chemical Industry
Energy Use

<u>Type</u>	<u>Units</u>	<u>Petajoules</u>	<u>Percentage of Total Consumed</u>	
			<u>1986</u>	<u>1981</u>
Natural Gas	3,839,878,643 m ³	142.843	47.10	38.55
Electricity	8,923,600 MWh	94.153	31.04	34.00
Liquid Petroleum Products				
Distillate Oil	40,733 m ³	1.632	0.54	0.62
Residual Oil	173,124 m ³	7.209	2.38	7.83
Diesel and Gasoline	2,540 m ³	0.101	0.03	0.51
Propane, LPG	129,049 m ³	4.759	1.57	2.00
Coal and Coke	n/a	1.420	0.47	0.31
Other Fuels				
Steam	n/a	6.644	2.19	3.85
By-products	n/a	<u>44.519</u>	<u>14.68</u>	<u>12.33</u>
Total		303.280		

Electricity is converted at 10,551 kJ/kWh

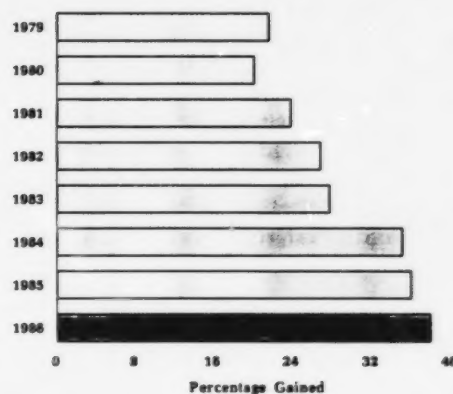
Other fuels include process by-products, vent gases, drips, slops, pitch, sulphur, hydrogen, waste oils, etc.



Electrical and Electronic Industry

Energy Conservation Task Force

P. Torbet
Chairman



The Decade Past ... And Future

A decade has passed since the Electrical and Electronic Industry Task Force released its first energy management report. Much has changed, both in terms of task force activities and on the energy management front itself.

In 1976, escalating oil prices and the spectre of energy shortages drove energy conservation programs to the top of the corporate agenda of many companies.

Conservation co-ordinators were commonplace. Companies were quick to jump onto the energy house-keeping bandwagon and turn off lights, turn down thermostats and organize energy awareness programs for their employees. Even capital-intensive retrofitting programs were undertaken regularly — because the energy savings more than justified the capital costs.

For the electrical and electronic sector (E&E) the past decade has been a time of remarkable progress. Membership in the task force grew from a handful of companies to more than 150. A standardized system of measuring energy efficiency was developed and implemented. Workshops, seminars, and most recently a series of technology transfer manuals, were developed to help companies share energy management expertise. Although a relatively low consumer of energy, the E&E sector since 1976 has posted a healthy 36% improvement in energy efficiency.

The years ahead however, pose new and potentially more difficult challenges. Falling oil prices have taken the heat off the corporate energy bill, especially in low energy consumption sectors. But experts warn that it is only a matter of time before the energy cycle comes full circle: oil prices are bound to rise, and supplies are ultimately limited.

The challenge for the task force will be to move energy awareness back to the top of the corporate agenda and make energy management a vital part of the management structure.

This will not be easy. Most companies feel they have already completed major energy-saving projects. Today, energy management is driven not so much by the need to conserve and cut costs, as by companies' increased preoccupation with productivity and quality issues. Energy management is no longer an end in itself; rather, it is a by-product of the need to be more competitive. In the E&E sector, companies have now graduated to the advanced level of energy management programs which emphasizes process and manufacturing improvements. For example: One company's decision to install a programmable controller on its electroplating operations not only increased production capacity by 100% and reduced rework by 66% but also cut water consumption by

more than 12,000 gallons. The result is increased productivity, more efficient use of natural resources and improvements in energy efficiency.

The Sector

Today, more than 150 companies participate in the Electrical and Electronic Industry Energy Management Task Force. They manufacture a variety of products used in the generation, transmission and distribution of electricity, such as generators, transformers, switchgear, electrical appliances, lighting equipment, communications apparatus, wire and cable, batteries, electronic systems and a variety of related high-tech components.

1986: A Year of Steady Growth

For companies in this sector, 1986 continued to be a stable, steady economic period. Manufacturing activity grew by just over 3.5%, a trend that reflected continued confidence in the Canadian economy. Yet, despite this economic upswing, our companies maintained, and in some cases consolidated their "mean and lean" strategy. They continued to do more, with less.

Increased manufacturing activity meant companies were making better use of existing productive capacity. At the same time, the drive to produce more with less also meant energy consumption did not increase proportionally. The result was a net increase in energy efficiency of 1.9% (with 34 of 150 companies reporting results).

Since 1975, the first year for which statistics were recorded, energy efficiency in the E&E sector has improved by 38%. The slowing rate of energy efficiency reflects the fact that major improvements in conservation programs were realized several years ago, and incremental gains today are largely the result of continued housekeeping efforts and improvements in productivity.

Task Force Activities

A major goal the task force set for 1986 was to revitalize interest in energy management among members of the industry. It tackled this objective on several fronts:

- Working in conjunction with the Department of Energy, Mines and Resources, the task force used a series of energy management modules designed to help companies implement specific energy-saving measures. Titles in the "Administrative" series include "Energy Management/Employee Participation" and "Energy Accounting". The technical modules include manuals on boiler plant systems; process furnaces, dryers and kilns; fans and pumps, etc. Each of these manuals was prepared by consultants, expert in their specific fields, and vetted by industry representatives.
- The task force organized two successful technology transfer workshops on "Heating, Ventilating and Air Conditioning". These sessions, which make use of the manuals in the energy management series, are designed to provide individual industries with practical information on transferring new technologies to their energy management effort.
- With one of its objects being to keep energy management on the front burner, the task force produced a quarterly newsletter that kept companies informed of developments.
- The task force distributed video tapes of Dr. Albert Bartlett's address to the 1985 task force energy management conference for chief executive officers in the industry. Dr. Bartlett, a renowned energy expert, contends that at the present 3% annual growth rate in consumption, world oil supplies will last less than 60 years; industry must, he says,

work to reduce energy growth. The task force's objective in distributing these tapes, which were made possible through the financial assistance of the Department of Energy, Mines and Resources, was to stimulate interest in energy use, especially at the senior, policy-making level of companies.

The Challenge Ahead

Of immediate concern is the need to give energy management programs a higher profile. To this end, the task force intends to expand the number and range of technology transfer workshops it will offer in 1987 and 1988. As well, it will continue to work diligently to involve more companies in both the task force and CIPEC itself.

The retrenchments of the 1980's, coupled with more recent economic recovery, has improved the profits of many companies. The combination of healthy profits and stable energy prices has lulled some companies into a false sense of security on energy supply and price. Energy management is not seen to be as important as it once was.

To meet the test of the global market place, Canadian companies in the coming years will have to expand and modernize their production facilities. The challenge for the task force then is two-fold: first, to make companies in the electrical and electronic sector more aware that the favourable energy situation we now enjoy is a temporary phenomenon; and second, to ensure that improvements in energy efficiency and conservation are part and parcel of every company's objective.

Electrical and Electronic Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	5,806,412 gigajoules
New base year (1985) equivalent energy inputs	5,870,021 gigajoules
Gross Improvement = 1.1%	
Adjustments	51,570 gigajoules
Adjusted base year equivalent	5,921,591 gigajoules
Net Improvement =	1.9%
Efficiency gain 1975 - 1985	36.1%
Total gain 1975 - 1986	38.0%

Electrical and Electronic Industry Energy Use

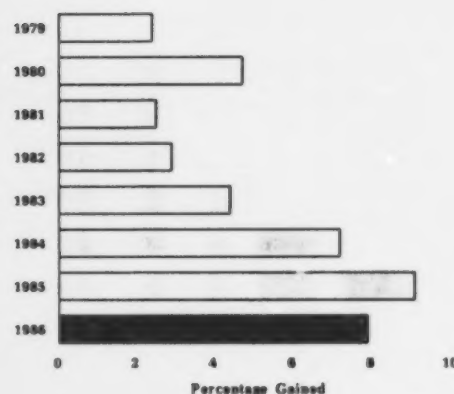
<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>1986</u>	<u>Percentage of Total Consumed</u>		
				<u>1985</u>	<u>1984</u>	<u>1983</u>
Natural Gas	89,401,768 m ³	3,325,742	57.3	59.6	58.4	58.6
Electricity	604,697 MWh	2,176,940	37.5	33.5	36.6	33.3
Liquid Petroleum Products						
Distillate Oil	2,041 kilolitres	79,631	1.4	0.6	1.0	1.8
Residual Oil	2,542 kilolitres	102,760	1.8	0.7	1.8	3.8
Diesel and Gasoline	684 kilolitres	25,298	0.4	0.1	0.1	0.3
Other Fuels						
Propane	636 kilolitres	16,916	0.3	4.0	0.8	0.7
Steam	n/a	79,125	1.3	1.5	1.3	1.5
Totals	1986	5,806,412				
	1985	5,841,065				
	1984	8,778,400				
	1983	8,886,142				
	1982	8,718,000				



Ferrous Metals Industry

Energy Conservation Task Force

Walter Cottle
Chairman



Task Force Description

The Ferrous Metals Industry Energy Conservation Task Force is represented by the steelmakers who comprise the Ferrous Industry Energy Research Association (FERA). The companies which provided data for the 1986 energy efficiency assessment include:

- Algoma Steel Corporation
- Dofasco Inc.
- Sidbec-Dosco Inc.
- Stelco Inc.
- Sydney Steel Corporation (Sysco)

Together, these companies represent about 85% of the total Canadian raw steel production and produce steel by the following techniques:

- blast furnace, basic oxygen and/or open hearth process
- direct reduction electric furnace
- electric steelmaking furnace

A partial listing of steel products would include:

- structural shapes
- flat rolled products
- forgings
- fasteners
- coated steel
- castings
- tubular products
- bar products
- wire and wire products

Steel is produced and/or processed at 33 plants among the member companies.

1986 Composite Energy Performance

Steel production decreased in 1986 to 11,594,290 tonnes from 12,446,344 tonnes in 1985 — a decrease of 6.8%.

The amount of energy consumed per tonne of raw steel was higher in 1986 at 22.90×10^9 Joules, compared

with 1985 at 22.63×10^9 Joules (an increase of 1.2%).

All participating companies achieved success in their plant energy conservation programs with a number of these achievements. However, certain factors overshadowed the conservation achievements in 1986 and resulted in a higher composite energy rate. Some of these negative factors include:

- reduced scrap proportions in the steelmaking process
- lower capacity utilization with associated energy penalties
- interruptions to the normal operating pace due to major construction projects and breakdowns.

Progress Towards the 1990 Energy Rate Goal

In 1986, the energy rate at 22.90×10^9 Joules/tonne was 1.2% higher

than the new base year of 1985, and is 9.5% higher than the 1990 energy goal of 20.91×10^9 Joules/tonne.

Task Force Technical Activities

The FERA Technical Committee meets several times per year to exchange information and develop joint programs leading to energy savings in member plants.

During 1986, the Committee developed plans and obtained senior management approval to hold a Steam Conservation Seminar. This is scheduled for the fall of 1987 and will provide opportunity for member companies to exchange practical information on techniques which have allowed them to trim steam consumption in their plants.

The Committee also decided to have a technical discussion on a prearranged topic at each of its regular meetings. In 1986, information was exchanged on temperature measurement in high temperature heating furnaces.

FERA also continued its contact with the International Flame Research Foundation (IFRF) through a special meeting with two senior members of that organization.

In addition to the above, the FERA Board of Directors continued negotiations with the Natural Sciences and Engineering Research Council (NSERC) and several Canadian universities on a proposed joint project entitled "Process Technology in Reheating Furnaces". The successful completion of this project will lead to improvements in energy efficiency, quality and productivity throughout the industry.

Conservation Projects for 1987

All participating companies expect to implement energy-saving measures in 1987. A sampling of the more significant items include:

- modifications to reheat furnaces to reduce the fuel rate
- generation of steam from waste heat sources, including steelmaking hoods and reheat furnaces
- improved steam conservation programs, including steam turbine upgrading, application of steam trap standards, etc.

The following is a partial listing of energy conservation achievements by task force members in 1986.

New Energy Efficient Installations

- A new pickle line installation with features resulting in lower processing and building heating energy use
- New reheat furnace in a bar mill with computerized combustion control

Modifications to Existing Equipment

- Economizers installed on large boilers
- Insulation of tuyeres to increase hot blast temperature
- Replacement of steam turbines

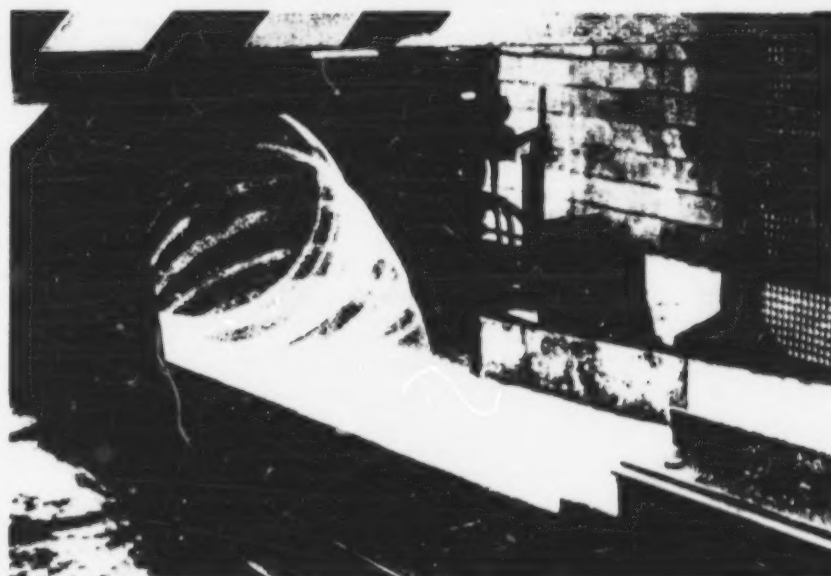
with electric motors or more efficient turbines to improve boiler house steam balance

Operating Changes

- Improved blast furnace fuel rates through the use of prefluxed pellets, lower silicon levels and hydrocarbon injectants
- Reduced hot metal use in steelmaking through the addition of anthracite coal
- Steam savings through the elimination of idling turbo blower for emergency backup
- Improved plant fuel balance by converting a battery to blast furnace gas

Housekeeping and Repetitive Maintenance

- Steam system conservation programs (traps, leaks, insulation)
- Continuous upgrading and repair of skid pipe insulation on reheat furnaces
- Frequent monitoring of condenser vacuums to minimize turbine steam consumption

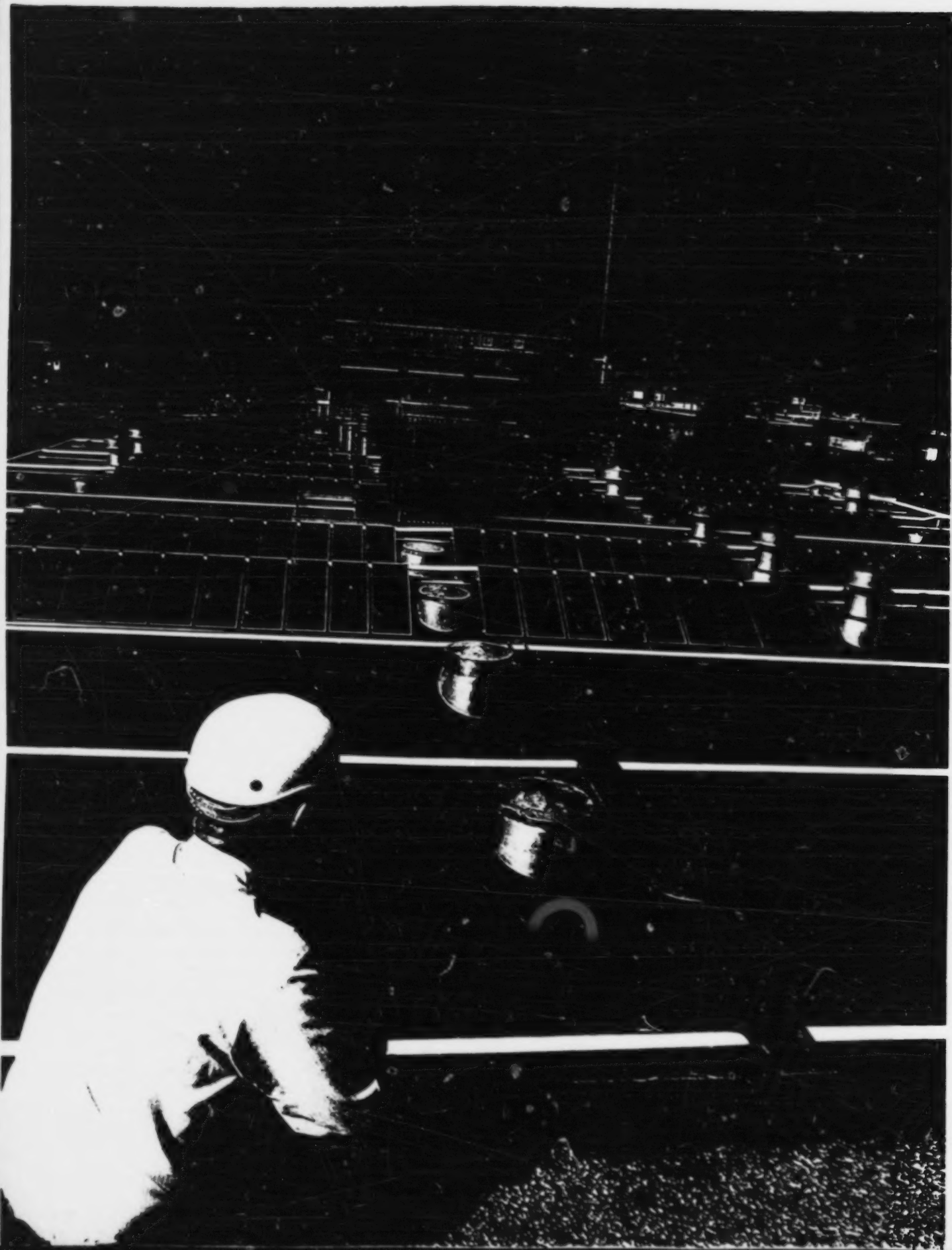


**Ferrous Metals Industry
Energy Efficiency Improvement**

Current year (1986) total energy inputs	265,487 terajoules
New base year (1985) equivalent energy inputs	262,354 terajoules
Net Improvement =	-1.2%
Adjustments — None	
Efficiency gain 1974 - 1985	9.1%
Total gain 1974 - 1986	7.9%

**Ferrous Metals Industry
Energy Use**

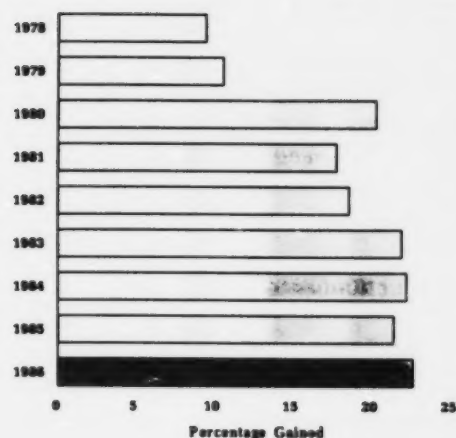
<u>Type</u>	<u>Units</u>	<u>Terajoules</u>	<u>Percentage of Total Consumed</u>	
			<u>1986</u>	<u>1985</u>
Natural Gas	1,407,446,200 m ³	52,357	19.7	20.2
Electricity	5,590,556 MWh	20,126	7.6	7.5
Liquid Petroleum Products				
Residual Oil	287,494,080 litres	12,161	4.6	4.1
Coal	6,235,966 tonnes	180,843	68.1	68.2
Total		265,487		



Food and Beverage Industry

Energy Conservation Task Force

A.L.W. Hyland
Chairman



This report covers the 1986 energy management performance of 130 separate companies, representing over 400 individual operations throughout 13 different trade associations of the Canadian food and beverage industry. The reporting population is about the same as in previous years, with sizes of operations ranging from large, integrated, multinational companies to small, locally-owned-and-operated facilities geared toward domestic markets.

1986 Performance

The energy efficiency gain in 1986 was 1.2% over last year's consolidated figure of 21.5%, making a total improvement of 22.7% (referenced to energy-intensity values experienced in the initial 1976 base year.) At this rate of gain in efficiency, the 31% target figure for 1990 should be achieved as anticipated.

On an estimated total energy cost of \$248.4 million, the participating

companies saved over \$5 million during 1986 due to the increased operating efficiencies.

Performances throughout the many diversified groups were somewhat mixed, but no particular pattern emerged to explain the differences. Even in those few groups that showed a downturn this year the attention to energy management remains strong. For example, in the meat packing industry the exceptionally high 5.3% average annual rate of improvement slipped this year, partly because of extended production interruptions. This group is continuing to audit plants and invest in new, efficient equipment. Meanwhile, in the confectionery industry, process consolidations and the manufacture of some more energy-intensive products had a negative impact on 1986 performance.

The specific energy conservation techniques mentioned most often this year involved computerized

monitoring and control of process equipment, the additional recovery of waste heat from hot water processes and refrigeration systems, and closer attention to production scheduling.

A number of fuel conversions were reported, indicating that even without government assistance some companies regard these projects as being economically viable. The most significant means of cost savings, however, have been through renegotiation of natural gas contracts. Upwards of 30% of the previous cost of natural gas is being saved. The possibilities of contract renegotiation under the new deregulation provisions are now at the stage where some large companies are negotiating blanket contracts for their operations in different regions, while other companies are co-operating to negotiate joint contracts.

Energy use performance was also helped by an increased rate of spend-

ing for new machinery and equipment in 1986. Spending on new capital equipment (at \$826 million) was 4.7% greater than 1985, whereas expenditures on the repair of existing equipment (at \$392 million) was at the same level as the year before. Since the food and beverage industry continually operates in the 78% to 79% capacity utilization range, the benefits from a high rate of renewal of process equipment should be even more noticeable in 1987 when early investment intentions suggest that spending will be 12.4% greater than 1986's rate.

Group Performance

Bakeries

Energy efficiency in the nation's six largest bakeries gained 0.7% during the year, but because of changes in the mix of energy used, different capacity utilization rates, shifts in product formulations, etc., the average energy-intensity for the group rose slightly to 2841 kilojoules per kilogram of output. One company completed in-depth audits in its different plants to identify new opportunities for further improvement.

The gradual shifting of energy shares, particularly in the past three years, reflects the changes in technology occurring in the baking industry. Higher shares of electricity (+3.3%), less natural gas (-8.3%), the same amount of fuel oil, and slightly more propane (+1.5%) reflect the continuing move to increased automation and electrified oven heating systems. However, with natural gas still comprising 65% of the total energy consumption, companies are looking to deregulated gas contracts as another means of lowering manufacturing costs.

Biscuit Manufacturers

Computerized monitoring, together with more careful production scheduling and controls, were cited

as major reasons for the performance improvement of 2.12% during 1986. The energy intensity of this industry's diverse product-line generally varies between 5000 and 7000 kilojoules per kilogram, depending on the product. Energy costs average about \$.05 per kilogram of output. One-half of the participants have definite investment plans for efficiency-improving retrofits during 1987.

Breweries

Energy conservation activities throughout the brewing industry display the long-term strategy of keeping close control over costs since the potential for large energy improvements is somewhat limited in this mature industry. In 1986, efficiency gained 0.8%, which lowered the average energy-intensity to 306 megajoules per hectolitre of production. This performance increase was achieved mostly through housekeeping activities such as steam trap maintenance, upgrading insulation on equipment, more economizers on boilers, and changing burners in furnaces. More extensive retrofits are being planned by the majority of the participants who claim to be willing to accept economic paybacks as long as 3.5 years.

The total energy conservation achievement of 6.1% over 1975 consumption understates the true energy management accomplishments in this industry. Most companies have modified their bottling operations since the base year and have added several new more energy-intensive brands, thereby detracting from gains made in other areas.

Distilleries

A very impressive average energy-efficiency gain of 5.9% was made in 1986, the highest in the food and beverage industry. This was mostly as a result of changes to key distillation equipment carried out by several companies. Many of the partici-

pants also reported that boiler stack economizers and burner controls were upgraded. Increasing recovery rates of condensate and heat from process hot water systems also appear to be popular in the group. These activities have lowered the average energy intensity to 42,696 kilojoules per litre (absolute) of production.

Three-quarters of the participants related plans for more conservation projects in 1987 and, on average, 3-year payback periods were deemed acceptable by the group.

Confectionery Manufacturers

Despite a large number of efficiency-improving activities, combined energy conservation performance was down 1.4% from 1985 due to major plant alterations made to accommodate new products. Total efficiency is now 24.2% over the 1978 level.

Energy improvements undertaken in 1986 included the replacement of several older conventional steam boilers with modern coil-tube boilers, the addition of insulation on process equipment, revisions to electrical systems to improve power factors and lighting, and installation of computer systems to optimize the operation of air conditioning and process equipment. Two-thirds of the reporting companies have planned retrofits for 1987 with 2-year payback conditions.

Food Processors

The efforts this group makes to conserve energy are complicated by the large swings in seasonal production. One solution has been provided by a demonstration project at the plant of E.D. Smith & Sons Limited in Winona, Ontario, where process and boiler feed water is preheated with solar energy. While the stand-alone economics are not yet favourable, the technology is being developed for future consideration.

Some members of the group are also switching to continuous cooking and vacuum hot-baking methods instead of the less-efficient batch cooking systems, and continue to make improvements to steam boilers and auxiliary process equipment. These techniques have resulted in a collective performance increase of 1.7% in 1986 which raises the total conservation achievement since 1976 to 18.2%.

Fisheries

In the fisheries sector, rapid strides are being made to modernize the industry now that the benefits of earlier industry rationalizations are taking effect. Energy conservation improvements are still being made in plant and processing equipment, but the major focus of attention at the present time is on the huge expense of diesel fuel used in trawler fleets. Computers are used to determine the best sailing speeds, operating ranges, refrigeration requirements, etc., relative to fishing and weather conditions at sea. This application of conservation technology resulted in a 3.7% gain in energy efficiency during 1986 to raise the total gain to 23.9% over the 1977 base year value.

Grocery Products

Energy efficiency in this group improved 2.59% during 1986 to raise the total amount of energy conserved since 1977 to 26%. No unusual projects were mentioned in the 1986 survey that would provide reasons for the continuing gain in performance. The distribution of energy remained consistent with the electricity share at 22%, natural gas at 72%, and fuel oils supplying nearly all of the remaining 6%.

Meat Packers

Even though total efficiency has been raised 36.6% since 1977, performance slipped 3.3% during 1986 as a result of decreased production volumes and more stringent en-

vironmental regulations. Since a large portion of the energy used in the packing industry goes into heating process water, this is the main target for significant savings. Firms indicated that 2-year to 5-year investment payback terms are acceptable on future energy conservation projects.

Natural gas accounts for 67% of the total energy used while electricity supplies 29%. Partly due to the lower individual performances during 1986, several companies report that previous audits are being updated, while electrical and combustion systems are also being monitored more carefully.

Poultry and Egg Processors

Heating and ventilation improvements are the main concern of participants in this industry where energy costs usually amount to 1.5% to 2% of the value of shipments. The average energy intensity for egg production is approximately 250 kilojoules per dozen. Efficiency improved 0.5% during the year partly due to the milder winter weather.

Soft Drink Producers

Energy conservation activities in this low energy-intensive, mixing and blending type operation usually are confined to improvements in HVAC equipment, building insulation, electrical power factor and lighting systems. Typically, annual energy costs of about \$100,000 comprise less than 2% of the value of shipments. In most of this industry, energy management is not a particularly high priority item although specific technical improvements, e.g., more efficient refrigeration systems, were mentioned as contributing to a reduction in operating expenses. Some companies, such as Misener Beverages Ltd. in Belleville, Ontario, have solar heating panels installed to preheat process water. In 1986, mild winter weather was also cited as a significant reason for the 3.7% gain in energy efficiency.

Starch Manufacturers

The 1986 performance was affected somewhat by minor changes in product-mix and increased production. The average efficiency of 1.21% brings the total gain since 1976 to the 32.02% level. Previous efficiency gains were the result of new plant constructions and improvements to boilers and heat recovery from the product drying systems in the established plants.

Sugar Manufacturers

Energy conservation lowered consumption by 2.4% in 1986 over 1985 to raise the total improvement to 30.8% since 1975. Performance was helped by a 7% gain in production although conservation activities involving more effective control of the heating processes also had an impact. The 1986 average energy intensity was 3675 megajoules per tonne melted. The shares of the different sources of energy in the total (electricity 3.7%, natural gas 69.8%, and fuel oil 26.5%) have not changed significantly over the past few years.

Task Force Activities

Task force activities during 1986 centred on the development of a new action plan to address the changing motivational factors and future complexities of energy management throughout the industry. A redesigned newsletter, preparations for another technical conference in the spring of 1987 and development of a computer monitoring program based on the Canada Packers Inc. system, were the main activities. The computer program is designed to operate from periodic meter readings to determine daily operating efficiencies and unit costs. This program will be made available to all companies.

Energy Use Patterns

The 1.1% increase in electricity use that coincided with an equal de-

crease in fuel oil consumption is mainly a result of plants located in Quebec shifting to electric steam boilers. This conversion trend is a result of successful promotion and cost subsidies by Hydro-Quebec.

Natural gas share of the total energy use for the industry remained virtually at the same level during 1986. The only recorded use of "waste" energy was in the fishing industry, where considerable quantities of fish oil are mixed with conventional fuels to be used as steam boiler fuel.

Since 1976, the food and beverage industry's overall proportion of energy use has changed significantly. The share of natural gas has increased by 20.9%, electricity use has gained 4.3%, and petroleum products have dropped by 23.7%. This long-term trend toward higher percentages of natural gas and electricity is expected to continue.

Future Outlook

Energy management will continue to receive close attention since general productivity gains are needed to maintain adequate profit margins. Faced with mature technologies and

slow growth rates, most companies will continue to concentrate on housekeeping activities and the application of proven technologies. Most investments will therefore be directed toward upgrading process equipment, especially adding programmable controls, rather than in-

creasing system capacities. The main source of energy savings will continue to be recovery of waste heat from processes and equipment.

Food and Beverage Industry Energy Costs and Savings

Trade Sector	Number in Survey	Energy Costs \$'000	Annualized Savings \$'000
Association of Canadian Biscuit Manufacturers	6	6,838	115
Association of Canadian Distillers	11	32,872	850
Bakery Council of Canada	6	8,388	153
Brewers Association of Canada	7	43,565	254
Canadian Food Processors Association	20	37,540	697
Canadian Meat Council	11	26,153	1,179
Canadian Poultry and Egg Processors Council	10	1,672	37
Canadian Soft Drink Association	22	2,938	115
Canadian Sugar Institute	5	21,976	632
Confectionery Manufacturers of Canada	11	8,775	274
Fisheries Council of Canada	4	12,727	383
Grocery Products Manufacturers of Canada	13	11,859	375
Starch Council of Canada	4	33,153	984
Totals	130	\$248,458	\$6,053

Food and Beverage Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	37,868,828 gigajoules
New base year (1985) equivalent energy inputs	38,344,000 gigajoules
Net Improvement =	1.2%
Adjustments — None	
Efficiency gain 1976 - 1985	21.5%
Total gain 1976 - 1986	22.7%

**Food and Beverage Industry
Energy Use**

<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>Percentage of Total Consumed</u>	
			<u>1986</u>	<u>1981</u>
Natural Gas	703,694,811 m ³	26,177,000	69.1	64.8
Electricity	2,045,000 MWh	7,362,000	19.4	14.6
Liquid Petroleum Products				
Distillate Oil }	95,238,165 litres	3,900,140	10.3	19.6
Residual Oil }				
Diesel and Gasoline	4,388,952 litres	168,608	0.5	0.6
Other Fuels				
Propane	5,879,108 litres	160,300	0.4	0.4
Steam	n/a	96,187	0.3	—
Waste Oil	n/a	4,593	—	—
Total		37,868,828		

**Food and Beverage Industry
Energy Performance**

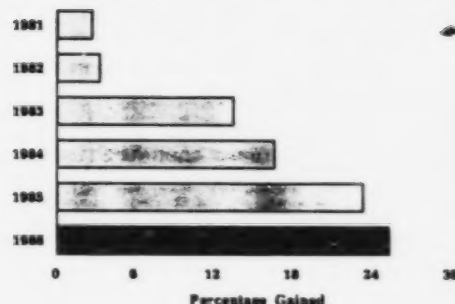
<u>Trade Sector</u>	<u>Improvement</u>		<u>Base Year</u>
	<u>1986 %</u>	<u>Total %</u>	
Association of Canadian Biscuit Manufacturers	2.12	11.66	1979
Association of Canadian Distillers	5.89	23.50	1976
Bakery Council of Canada	0.70	12.60	1979
Brewers Association of Canada	0.82	6.09	1975
Canadian Food Processors Association	1.69	18.24	1976
Canadian Meat Council	-3.33	36.67	1977
Canadian Poultry and Egg Processors Council	0.50	8.70	1982
Canadian Soft Drink Association	3.70	28.25	1980
Canadian Sugar Institute	2.41	30.78	1975
Confectionery Manufacturers of Canada	-1.43	24.23	1978
Fisheries Council of Canada	3.70	23.91	1977
Grocery Products Manufacturers of Canada	2.59	25.99	1977
Starch Council of Canada	1.21	32.02	1976
Totals	1.24	22.77	1976



General Manufacturing

Energy Conservation Task Force

Bent K. Larsen
Chairman



In the 1986 survey, 67 members of The Canadian Manufacturers' Association (CMA) reported performance results on some 275 individual plant sites. The participants form a diverse group of manufacturers with different energy-intensities. For example, surveys were again returned by light manufacturing and fabrication type companies, foundries, forging operations and heavy metal processors; rubber product manufacturers; chemical, medical and pharmaceutical producers, and producers of miscellaneous products that do not fit into the standard industry task force classifications. Even though the survey mix is virtually the same as in previous years, making it possible to compare year-to-year total results, it is still necessary to generalize some of the smaller groups' results to provide a reasonably coherent analysis.

The survey covers large energy-intensive companies that spend over \$27 million for energy, as well as

small, low energy-intensive firms that spend less than \$100,000 per year.

General Performance and Business Conditions

For the surveyed companies, consolidated energy efficiency gains increased 1.9% during 1986. This annual gain is the lowest increase experienced in the past five years when there were 4.7% average annual gains. Nevertheless, overall energy efficiency has improved by 25.3% over 1981 operating standards. Even though the survey covers only 275 individual plants, the results should still be indicative of the actual performance of the general manufacturing sector because of the broad coverage of the participating companies.

Participants spent \$66 million on electricity, \$42 million on natural gas, and \$15 million on petroleum products. This means the partici-

pants actually saved \$2.4 million due to 1986's performance gains — even taking into consideration the increased cost of energy and the extra consumption required for higher production levels in many of the companies.

Some groups fared better than others. The foundry-forging-heavy-metal processing group showed an average improvement of 2.4% during the year, while the light metal fabricators turned in a 2.3% improvement. Rubber products and the chemical-pharmaceutical-medical product manufacturers both showed only a 1% efficiency gain.

Energy Management Survey Results

In this year's survey, in addition to the usual queries of efficiency change, all companies were asked a few questions about their prevailing energy management strategies and activities. The questions related to the level of organization responsi-

bility, project payback criteria, total energy cost ratios versus production costs, and intentions of implementing projects in 1987. Other questions asked about the type of deregulated natural gas contracts being used. The goal of the questionnaire was to determine approximately the cost savings achieved from these energy management activities.

Nearly three-quarters of the companies stated they planned to implement energy conservation projects in 1987. While the majority of these companies were diversified energy-intensive companies that spent more than \$500,000 on energy, several of the smaller, moderately energy-intensive companies, spending in the range of \$110,000 for energy, also reported having plans for conservation projects. However, in the \$1 million-and-up category, six companies showed no intentions for specific energy retrofits. It would therefore appear that while investment strategies are mixed, energy conservation projects are occurring in a good number of companies in spite of the belief that soft energy prices have made energy conservation a low priority item. Many companies report that energy projects are often included as part of their comprehensive productivity improvement plans.

The overwhelming success of the province of Ontario's new Industrial Energy Service Program for auditing the efficiency of processes and major utilities, instead of buildings and minor facilities, is showing how government can respond effectively to industry's need for energy improvement. These in-depth audits are helping to expose some lucrative opportunities that would perhaps not be found if left to the lean resources prevailing in many manufacturing companies today.

There was no discernible relationship between current efficiency gains and intentions to implement future conservation projects. Individual strategies and investment

decisions in specific areas remain as varied as the factors that affect capital spending. These include the present rate of capacity utilization, probable future demand and product prices, competitive position, interest rates, cost of the investment itself, and what is happening to the company's other costs.

The psychological climate produced by the combination of all of these economic factors determines what and how many investments take place. In 1986, for example, the investment attitude was cautiously aggressive at the beginning of the year as a result of the 1985 investment momentum, but it tightened up somewhat in the fourth quarter when company profit margins started to decline. In addition to the factors noted above that pertain to each individual company, investment decisions are also affected by a host of external factors, such as tax and depreciation rates, possible government incentives, economic forecasts, expectations of energy prices, possible free trade agreements, structural changes in the economy, and other "hot issues" like new environmental regulations.

Of course, companies must also possess a certain amount of technical and managerial expertise to undertake technical improvements. The situation during 1986 was still one of cutting back on the size and experience level of supporting staffs. This is in contrast to the situation in the United States where surveys show that companies have started to restore some middle management and engineering capabilities.

Given the above considerations, the fact that most of the companies have scheduled energy conservation projects, presumably in addition to ongoing housekeeping activities, points to a solidly integrated but largely unheralded position of energy management in companies' total activity.

The survey indicated a distribution of energy management responsibilities to plant managers (28%), plant engineers (21%), engineering managers (12%), chief operating engineers (12%), vice-presidents (9%), general managers (7%), presidents (7%), and cost accountants and others (4%). The highest proportion of assignments to plant managers, who normally perform a multifunction role, suggests that specific energy conservation improvements in the plant continue to focus primarily on the end-use of energy where well-known technologies can be easily applied. It is usually the plant engineers and engineering managers, however, who introduce the capital projects.

The surprising disclosure that so many chief operating engineers were responsible for energy management, all within the larger companies spending more than \$1 million per year, supports the notion that more companies have management structures styled after "line" rather than "staff" responsibility. Giving energy management control to the man "with his hand on the throttle" is viewed as more effective than having energy committees where the strategy called for broad employee involvement and voluntary actions.

A sharper distinction is now being made as to the daily responsibility for operating the plant more efficiently as opposed to the long-term gains from engineered projects.

In the instances where senior management carries the responsibility for energy management, the reasons are different from above. For example, the companies in the survey spending the most for energy indicated a vice-president in charge, presumably to co-ordinate and/or delegate certain tasks to supporting staffs. At the other end of the cost scale, a vice-president/general manager evidently has sole responsibility. Where delegation has been made to cost accountants and others,

energy costs are small and/or the energy cost versus manufacturing expense ratio is less than 5%.

Virtually all of the respondents were careful to state who was in charge. It would appear that general energy management styles are now much more focused than during the pre-recession period of shared responsibilities and a broad commitment. Again, this reflects the "lean and mean" strategies prevalent in most companies.

All respondents except five were acutely aware of their energy cost versus manufacturing expense ratios. Two "unknowns" came from chief operating engineers who may not have had access to overall manufacturing budgets. Two were from vice-presidents who may have felt the information was confidential. The fifth "unknown" came from a new reporting company which may indicate that its energy management monitoring is still in the development stage.

The picture was not clear with respect to the acceptable economic payback terms. The most often mentioned norm was the standard two to three years. Two companies in the \$1 million-and-up category mentioned that four and five year paybacks on energy projects would be acceptable. Generally, smaller companies required shorter paybacks or did not indicate a time because of fewer planned commitments. There did not appear to be any relationship between payback terms and capacity utilization rates. Even though many companies are investing heavily in productivity improvement projects, the overriding strategy is to use some of the currently available profits to repair corporate balance sheets. Better debt-equity ratios, higher internal rates of return and low prime borrowing rates are helping to lengthen payback terms.

With respect to deregulated natural gas contracts, twice as many

companies are benefiting from Competitive Marketing Program (CMP) type contracts than those who are not, and in a few instances big customers are purchasing natural gas directly from primary producers. Many of the companies under regular contracts either rely mostly on electricity for their power or are located in regions where the gas utility cannot offer these options. Companies spending as little as \$100,000 for energy have some form of deregulated contract as a result of, in many cases, the gas companies' desire to retain their customers and market share. It is estimated that an average cost-saving from negotiating a new contract ranges between 5% and 20%, depending on the plant location, amount purchased, load patterns, and competitive alternatives.

Group Trends

Rubber Products

Energy improvement in the eight rubber product companies decelerated to 1.08% in 1986 compared with 5% average annual gains in previous years. Efficiency grew slowly last year because production volumes were down and there was general uncertainty in the tire manufacturing business. For instance, the 22 million units per year tire business in Canada has seen its market dwindle by 30% in the past 10 years due to the rising tide of imported cars. Furthermore, about 20% of the replacement tire business has been replaced by imports. Likewise, recent slippage in exports to the United States, which account for 50% of domestic production, is occurring as a result of protectionist decisions by the U.S. parent organizations. As a result, most Canadian tire companies have been in the throes of rationalization, including mergers, and several inefficient and outdated facilities have been closed. Three of 12 producing plants have recently shutdown, raising the capacities of the remaining plants into the 70% to 90% range. Some investment in

new technologies has occurred in the surviving plants.

Most Canadian plants are quite modern and efficient, but the need for further modernization is well recognized. Various investment schemes, including duty remissions, which would be augmented by government, are now being discussed as sources of the necessary funds. The unit cost of energy in the tire manufacturing process, not including the raw material content, varies between \$1.5 and \$3 depending on the plant's location and employed technology. This amounts to approximately 5% of the cost of production.

Chemical, Pharmaceutical and Medical Products

The seven companies in this group operate 24 different plants that produce a variety of chemicals such as sodium chlorate, paint and varnish, as well as intermediates and raw materials for the cosmetic and pharmaceutical industry.

The group's energy efficiency improved 1% in 1986, much slower than previous years when average gains of 5% per year were reported. Three of the seven companies stated that energy conservation projects were scheduled for implementation in 1987.

A review of each company's proportion of energy sources shows no basic changes in the past few years that would suggest any major fuel switching or special impact of energy conservation actions. However, five of the seven have evidently taken advantage of the deregulated natural gas contracts. One of the other two companies uses electricity as its main energy source.

Foundries, Forging, and Heavy Metal Operations

Sixteen companies in this energy-intensive category had efficiency gains that averaged 2.41% for the

year. Energy costs usually amount to 10% to 15% of the total manufacturing expenses with non-ferrous foundries the least demanding. Grey iron foundries and forging operations are situated at the high end of the energy-intensive scale.

Performance results were not as high as last year's 4% gain, partly because of lower production volumes which generally dropped capacity utilizations into the 60% to 70% range for most plants. Less than one-quarter of the companies stated any intentions of implementing energy conservation projects in 1987. Housekeeping actions continue to be the mainstay of energy management programs in this group.

Energy distribution is gradually changing towards increased amounts of electricity for induction heating, especially in Quebec where very attractive off-peak power rates are available for high-load customers. Overall, electricity constitutes 41% of the total input energy, with natural gas supplying 57%.

Light Manufacturing

Thirty-six companies reported an average 2.4% gain during 1986 in this moderately energy-intensive sector where energy costs fall between 5% and 10% of total production expenses. The companies in this group make such items as office furniture and equipment, HVAC equipment, extruded aluminum products for residential and commercial use, photographic apparatus, prefabricated industrial buildings, plumbing and industrial supplies, etc. Typical energy distribution percentages amount to 67% for natural gas, 26% for electricity, and the balance for small amounts of standby fuel oil and for plant vehicles.

Manufacturers in this sector are most concerned with the energy losses from the building envelope and, secondarily, with recovery of

waste heat from exhaust systems and equipment such as air compressors. According to the results of recent energy audits done in this industry sector, added building and equipment insulation is still justified in two-thirds of the instances. The frequency of economically viable heat recovery applications applies to about one-third of the sites, and it has been found that about one-quarter of plants should still make power factor and load control improvements.

Typical plant energy-intensities in this group are: metal stamping operations, 640 kW/m² of floor space; office equipment and furniture manufacturing, 795 kW/m²; scientific and photographic equipment plants, 830 kW/m²; aluminum extruders, 1080 kW/m²; and machine shop type operations, 1150 kW/m².

Future Outlook

General business and economic conditions in 1986 were conducive to increased energy operating efficiency, but the outlook for 1987 and beyond is not as good. In 1986, the manufacturing industry's gross domestic product increased 3.1%, the production index rose 2.5%, after-tax profit margins gained 2.5% and the capacity utilization rate hovered around the 78% mark. Investment of new capital equipment and machinery increased 28.4% over the 1985 level of spending.

The forecast growth in real GDP for 1987 and 1988 is between 2.5% and 2.75%, according to OECD economists. From the Statistics Canada annual survey (Cat. 61-205), capital spending intentions for new machinery and equipment show an increase of 10.5% from the 1986 investment level.

Energy prices are forecast to rise moderately in 1987 and 1988. The latest OPEC agreement (December 1986) to reduce production and restore a fixed price of US\$18 has

added some stability to the international market, but OPEC's resolve is still considered to be very fragile. However, international crude oil (FOB) spot prices are expected to rise from US\$15 in 1986 to an average US\$16.75 in 1987 and US\$17.75 in 1988. Domestic crude oil (Toronto) prices could then average Can\$23.80 in 1987 and Can\$25.00 in 1988 — up from the \$22.00 experienced in 1986.

Natural gas (Toronto) prices are expected to be \$3.70 per MMBtu in 1987 and climb to \$3.80 per MMBtu in 1988.

Companies are therefore beginning to exercise more caution in their business affairs. Some companies continue to scale down their operations and are shutting down old plants. In multiproduct companies the strategy now calls for "focused manufacturing" and/or worldwide "mandated manufacturing." The essence of this strategy is to concentrate the production of fewer products in smaller plants that are located closer to their customers. Manufacturing companies no longer see strength in diversity. All this means that energy efficiency will continue to improve as companies rebuild, relocate, and revitalize their operations.

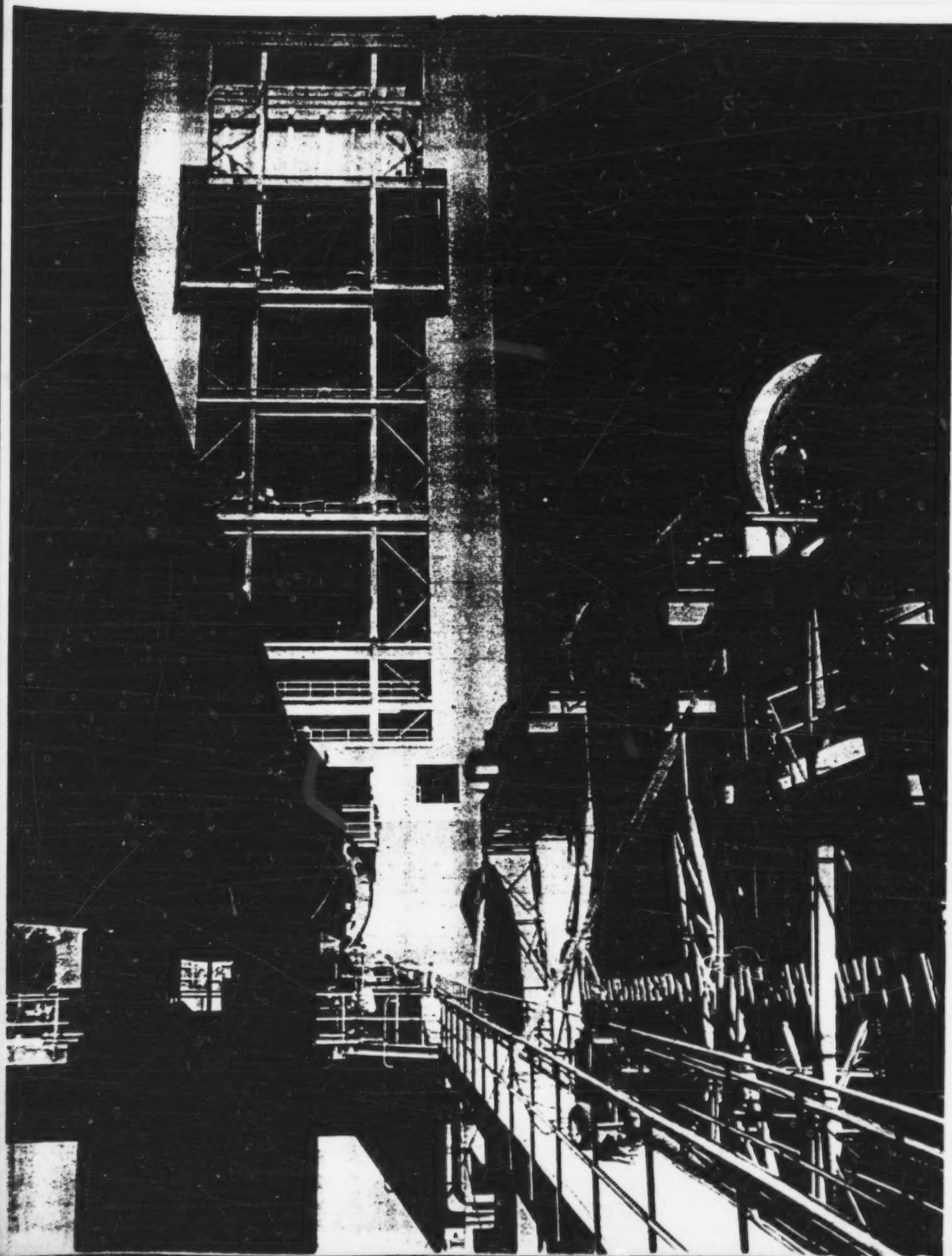
The 1990 General Manufacturing energy efficiency improvement goal of 33%, compared with 1981 equivalent operating standards, should therefore be achieved at the current rate of progress.

**General Manufacturing Industry
Energy Efficiency Improvement**

Current year (1986) total energy inputs	16,335,585 gigajoules
New base year (1985) equivalent energy inputs	16,652,830 gigajoules
Net Improvement =	1.9%
Adjustments — None	
Efficiency gain 1981 - 1985	23.4%
Total gain 1981 - 1986	25.3%

**General Manufacturing Industry
Energy Use**

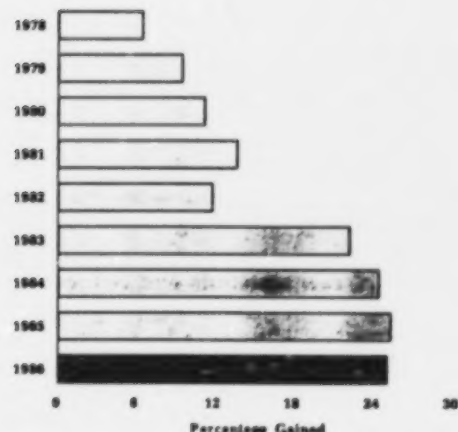
<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>Percentage of Total Consumed</u>		
			<u>1986</u>	<u>1983</u>	<u>1980</u>
Natural Gas	235,558,637 m ³	8,762,781	53.6	59.6	52.9
Electricity	1,601,000 MWh	5,763,480	35.3	28.1	26.1
Liquid Petroleum Products					
Distillate Oil	2,957,857 litres	115,356	0.7	0.4	1.8
Residual Oil	33,177,500 litres	1,397,313	8.5	10.6	15.9
Diesel	2,800,000 litres	111,721	0.7	0.4	2.2
Gasoline	2,099,379 litres	75,997	0.5	0.2	0.7
Other Fuels					
Propane	1,623,921 litres	44,531	0.3	0.6	0.2
Steam	n/a	36,420	0.2	0.1	0.2
Others	n/a	27,986	0.2	—	—
Total		16,335,585			



Industrial Minerals Industry

Energy Conservation Task Force

John A. Clarke
Chairman



Task Force Description

The Industrial Minerals Energy Conservation Task Force represents nine separate industries that mine, process and manufacture a variety of non-metallic products used throughout the nation, primarily for construction and industrial purposes. The real GDP of these industries was approximately \$7.5 billion in 1986.

It is estimated that 75% of the energy used in the total industrial minerals industry is accounted for by the 55 companies participating in this report. In three of the most energy-intensive sectors, i.e., cement, glass, and raw abrasives manufacturing, the report covers virtually all of the existing manufacturers. In the less energy-intensive or diversified sectors, where there are more than 1000 individual firms, the reporting population usually consists of the largest companies in each group.

Performance

In 1986, the collective energy operating efficiency slipped 0.28% over 1985's achievement of 25.4%. This was the first negative aggregate performance since reporting began in 1975. However, eight of the nine sectors achieved positive gains between 1% and 4.45% during 1986.

In the industry, high levels of capacity utilization and investment in new machinery and equipment greatly assisted energy conservation. Capital expenditures on construction, machinery and equipment, according to Statistics Canada, totalled \$580 million in 1986, with \$269 million of this amount invested in new equipment and machinery. Spending in the latter category was up an extraordinary 39% over the level of investment in 1985, denoting the industry's improved profit status and intention to accelerate the rate of modernization. Investment forecasts for 1987 show another increase of 7.6% above the 1986 rates

with nearly all of the increase budgeted for new equipment.

The cement manufacturing sector, which is the largest energy-consuming sector in the survey with 53% of the total consumption, was not able, however, to operate at the previous high-efficiency standard. It became necessary to operate several less-efficient "wet-process" type plants at maximum capacity to meet swelling market demand in the construction industry.

Sector Reports

Abrasives

Energy utilization improved 1.26% during 1986 in Abrasives' high energy-intensive companies, raising the gains during the past four years to 8.98%. The five participating companies represent all of the primary producers of raw aluminum-oxide and silicon-carbide and about 95% of the total abrasives manufacturing industry.

Energy costs are estimated to have been \$23.5 million, which normally constitutes about 15% of the total manufacturing costs. Electricity continued to provide 87% of the total input, with coke (7.5%) and natural gas (4.8%) the remainder. These percentages have not changed appreciably since collective performance monitoring began in 1975.

Energy conservation measures taken by the participating companies have concentrated on optimizing the efficiency of electricity (installation of power factor and load control apparatus), some miscellaneous fuel switching to natural gas, and adjustments in the compositions of raw materials and reducing fluxes. Since the average capacity utilization is in the order of 70%, some latitude exists for production scheduling to take advantage of off-peak electrical rates.

Asbestos

Even though total production in the Asbestos industry continues to decline (631,797 tonnes of raw fibre in 1986 versus 666,942 tonnes in 1985), energy utilization was 2.7% better than 1985 and 8.5% lower than the consumption rates experienced in 1979. The decreased energy consumption was due mainly to extensive rationalization of some companies' Quebec operations, raising the industry's capacity utilization rate from about 60% in 1982 to 75% today. By closing down some marginal operations, the energy-intensity for the entire group has been lowered to 7168 megajoules/tonne.

This industry depends on fuel oil for its major source of energy. In fact, the one reporting British Columbia company burns oil to generate electricity for the mill and to meet the town site requirements. In this case, a unique energy management situation exists where a great variety of conservation measures have been taken to significantly lower the use of fuel oil. In the Quebec locations, 35% of the total

energy is supplied by purchased electricity. Natural gas is not purchased by any company so there is no opportunity to benefit from the de-regulated natural gas prices.

Cement Manufacturing

The positive trend in lowering energy intensities was interrupted in 1986 when 2.0% was knocked off the previous recorded gains of 26.3% relative to 1974 standards. The decrease was caused by a number of business-related activities. The booming construction market in central Canada forced some companies to supplement their capacity with older, less-efficient wet-process kilns. Less waste heat can be recovered from the wet-process operations, making the entire plant's energy efficiency decline slightly. Elsewhere in Canada, existing plant capacities were somewhat underutilized. Even though some companies reported maximum output, total capacity utilization, according to Statscan, was only 78%. One company also experienced a prolonged labour dispute.

The nine hydraulic cement manufacturers make almost all of the cement required for domestic purposes as well as a good portion of the markets in the northeastern United States. Total 1986 production was 8.7 million tonnes of clinker and 8.9 million tonnes of cement, with 80% of the total manufactured in the dry-process type plants that are generally 30% more energy efficient than the wet-process type plants.

Canadian plants are world-scale in size and among the most technologically advanced in the world. A dry-process plant with combustion preheating now requires about 4769 megajoules per equivalent-tonne while a wet-process plant, also with preheated combustion air, takes 6153 megajoules per equivalent tonne. Furthermore, 88.6% of the total energy is supplied from fossil fuel and of this, 70% comes from

coal and coke and 24.6% from natural gas. Petroleum products contribute only 5% to the fossil fuel input.

Since energy monitoring began in 1974, the percentage of coal use has increased from 10.8% of the fossil fuel input to 70.4%. During this period the natural gas share dropped from 49.5% to 24.6% and the fuel oil percentage also dropped, from 39.7% to 5%. The fuel substitution activities have stopped for the time being because of the balanced economics of the different fuel alternatives and the cost of any further changes in the equipment.

However, since large amounts of coal are being used to fire the kilns, cheaper fuel alternatives are still being investigated. For example, at the St. Lawrence Cement Inc. (Mississauga) plant, the feasibility of substituting 10% to 20% of the coal-based energy with Refuse Derived Fuel (RDF) is being discussed. Not only are the economics of a cheaper fuel source possible, but there is also a direct benefit to the community where clean incineration will lessen the burden on costly landfill sites.

Clay Brick, Tile and Clay Products

Efficiency improved 2.34% in the participating clay product manufacturers to lower the average energy-intensity per unit of production of the group 27.27% since performance monitoring began in 1976. The curing of clay products is a very energy-intensive process, that is, clay bricks require about 8483 kilojoules per tonne with most of this energy (93%) supplied by natural gas and/or fuel oil — depending on the location of the manufacturer. Only 7% of the total energy is supplied by electricity. Energy costs of approximately \$30 to \$40 per thousand bricks usually constitute about 15% of the cost of manufacturing.

Operating efficiencies were helped by exceptionally high production rates in 1986 in most of the industry. Some companies located

in Ontario, for example, had to import bricks from their western Canadian and United States operations to meet demand. This meant that production in the Ontario companies was at its peak.

Performances were also helped by active energy management programs. Kiln combustion control systems continue to receive the closest attention. Moreover, one company reports that oxygen enrichment and propane fuel injection techniques are being used to augment combustion efficiencies beyond the usual levels. One-half of the participants indicated that energy conservation projects are scheduled for 1987 with 5-year economic payback periods considered acceptable.

Concrete Products

Similar to other construction supply material industries, the concrete block and redi-mix suppliers experienced 2.2% better performance in 1986 because of higher production rates and milder weather conditions. In this sector, the normal energy requirements are 10% electricity, 75% natural gas, 10% diesel fuel, and the remainder gasoline and standby fuel oil. Most of the companies have renegotiated natural gas contracts.

Unspecified energy conservation projects are planned by two of the larger companies (the eight participating companies operate 14 different plants) with 5-year return on investment being acceptable. However, common housekeeping solutions that minimize energy wastes are still being reported as the backbone of energy management programs in this relatively low energy-intensive industry.

The average energy requirement of 9MJ to 10MJ per block-equivalent is quite uniform among the participants because of the consistency of the ingredients and the nature of the production equipment. Most companies have made all possible technical improvements in the curing

kilns leaving only production scheduling and minor changes in the steam generators as a means for further improvement.

Glass Manufacturing

Within the industrial minerals industry, glass manufacturers are the most energy-intensive with requirements in the 8700 megajoules per tonne range. Of course, there are moderate variations in each company because of the different melting furnace configurations, economies of scale, percentage of used materials recycled, and type of end-products. The five participating companies, operating 19 different plants, account for approximately 90% of all the glass manufactured in Canada.

In 1986, average energy conservation performance gained 0.8% from the 1985 level of 33.2% (referenced to 1974). Compared to the operating efficiencies experienced in 1974, the participants are now saving about \$9.7 million per year as a result of various energy conservation improvements and cost savings from deregulated natural gas contracts. In some cases, companies are saving more than 20% on the rates charged only two years ago. However, energy costs still amount to approximately 15% of manufacturing expenses and every means possible is being taken to lower these costs.

In the past, large efficiency gains have been realized by installation of electric boosters in the melting furnaces, reclamation of exhaust heat, installation of sophisticated combustion control systems, improved furnace designs, and through the use of extended-life furnace insulating brick.

Another way of saving energy now being tried involves adding heat to the furnaces via the preheated batch and recycled feedstock (cullet). The main advantage of cullet preheating is to increase the existing furnace throughputs while, at the same time,

accommodating an increasing percentage of recycled glass. Tests show that with a suitable blend of cullet and batch material heated to about 320° Celsius, the production capacity of a typical 250 tonnes per day furnace can be raised to 380 tonnes per day without any extra heat added to the furnace other than by the cullet. Furthermore, the cullet preheater operates at about twice the thermal efficiency of a normal furnace even when the latter is equipped with electrical boost heaters. The economic payback on this new production technique is reported to be very short.

New technologies, as outlined, should boost the total conservation achievement to 50% by 1990, the improvement goal previously established relative to 1974 operating standards. The glass industry, because of the high energy intensities and competition from plastics, is practising energy management in a very aggressive manner. All companies are operating on the leading edge of known world technologies and make every effort to introduce all of the viable improvements.

Lime Manufacturing

The basic lime manufacturing technology is similar to the cement manufacturing process in that quarried rock is crushed, screened, and calcined in rotary kilns that are fuelled by either natural gas and/or large quantities of coal. The leading uses of lime products are for fluxing of raw steel in basic oxygen furnaces, for alkalies, construction materials, water purification, refractory dolomite, and for other chemical uses. Energy utilization performance is therefore primarily related to the business conditions in the steel and construction industries where, in 1986, a healthy market situation led to a 10% increase in lime product output. An average 75% capacity utilization rate has now raised the participating companies into a more efficient operating range. The four participants represent about 50% of

the total capacity of Canadian manufacturers.

The higher production levels, plus installation of computerized controls on one of the kilns and other general plant improvements, resulted in a 2.28% gain in group performance in 1986. Total efficiency gains from 1979 standards are now up 15.76%. Energy-intensity per unit of production averages 6254 megajoules per tonne in the industry, with purchased or self-generated electricity amounting to about 76 kWh/tonne, and natural gas or coal providing the remaining 5980 megajoules per tonne of energy. Natural gas continues to be the most often used fuel since it produces the highest purity products. Three of the four participating companies generate their own electricity.

Miscellaneous Minerals

This diverse sector manufactures a variety of products such as roofing granules, silica, nepheline, raw crushed limestone and gypsum products. In Canada, the GDP (at factor cost) of miscellaneous minerals (SIC 359) amounted to \$640 million in 1986 and was exceeded in size only by the glass and glass products sector. Even though there are only four major companies reporting, they represent a good cross section of industry conditions since they each operate several plants in different regions.

While group energy-intensity values in this diverse group cannot be generalized, steady efficiency improvements are nevertheless being made at the rate of 2% per year. The weighted average of performances

indicates that efficiencies are 10.7% better than operating conditions experienced in 1977. Of the total 3.79 petajoules used by the participants in 1986 — costing about \$25 million — electricity provided about 24%, natural gas 65%, and miscellaneous fuel oil and liquefied gas 7%. The remaining 4% was derived from plant wastes and carbon-based materials.

Specific energy conservation savings mentioned in 1986 included: installation of new process equipment (fluidized bed dryers), revised process operating conditions resulting in lowered operating temperatures, and installation of steam boiler heat recovery apparatus. In addition, improvements in energy monitoring have been made to ensure that new natural gas contract consumptions stay within the prescribed limits.

Refractories

Energy management is a major activity in this sector because of the very high energy-intensity of the fired products, which amounts to about 6500 megajoules per tonne of production, and the general difficulties in improving the methods of manufacture. Some major breakthroughs were made, however, since 40% of the total 11% gain since 1974 occurred in 1986.

The participating companies are in a very competitive situation and were therefore not prepared to elaborate on their energy conservation activities for 1986. One company contact stated: "We were doing all kinds of good things to lower energy costs to gain a competitive

edge". This seemed to typify the aggressive management attitude throughout the sector.

The technology in the refractories sector is gradually changing as substitutes, such as blanket materials and castables, take the place of traditional fired products. These new products are not only less energy-intensive, but also offer much lower installation costs. There is, likewise, continual research into new ceramics that will withstand ultrahigh operating temperatures and/or resist corrosive agents. Some of these new products are more energy demanding and are part of the cause for the relatively modest total change in energy consumption since 1974.

Future Outlook

The temporary downturn in the efficiency of energy use in the cement manufacturing industry is expected to turn positive again in 1987 when the related construction industry activities subside a little.

The energy efficiency forecast for the whole industry is expected to improve steadily in the next few years by an average rate of about 2.0% per year. The increased rate of investment in new machinery and equipment should also contribute to future energy utilization gains for the latter part of the 1980's.

The task force should therefore reach the 1990 group conservation target of 10% over the new 1985 base year — 35% better than equivalent operating standards in 1975.

**Industrial Minerals Industry
Energy Efficiency Improvement**

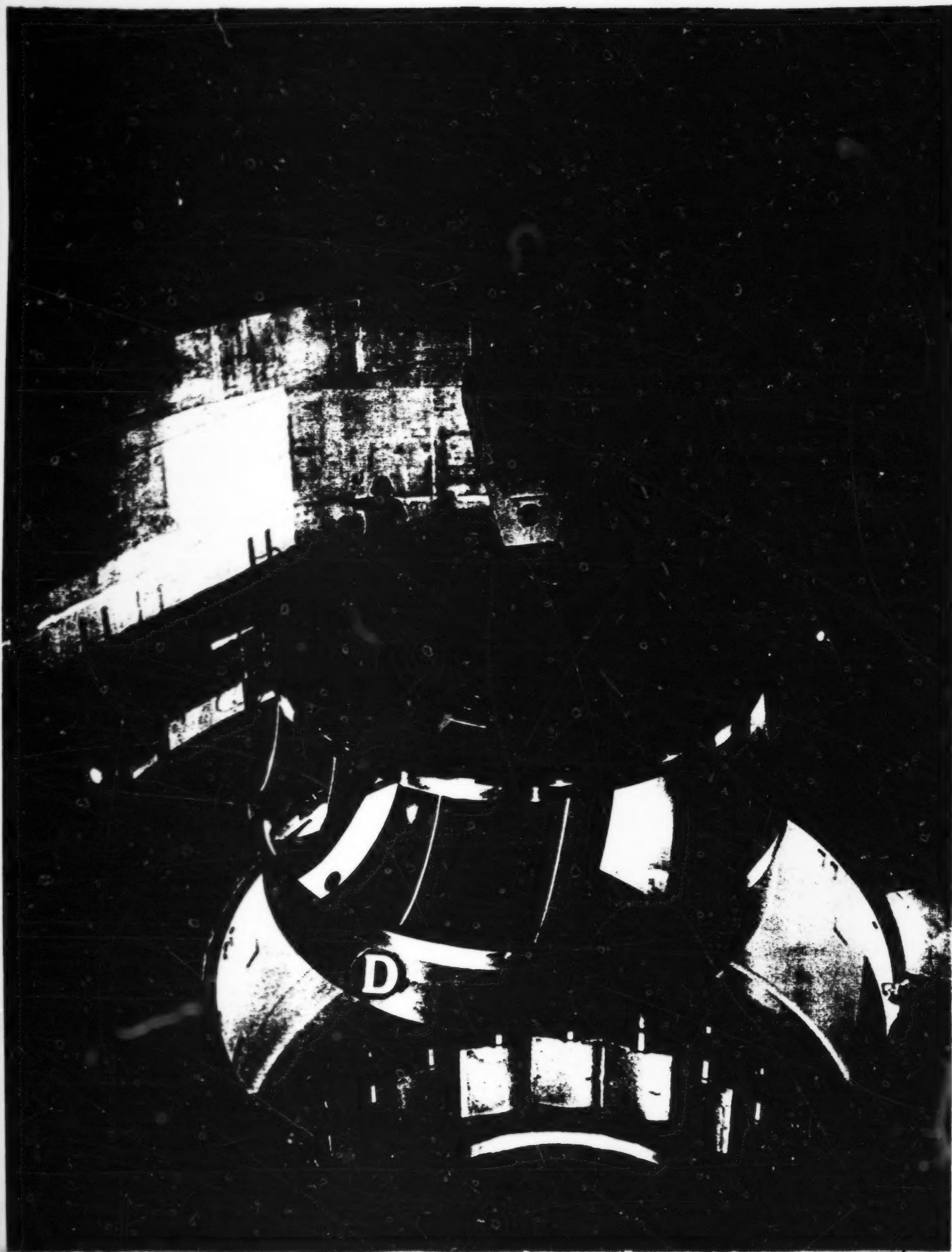
Current year (1986) total energy inputs	82.632 petajoules
New base year (1985) equivalent energy inputs	82.405 petajoules
Net Improvement =	-0.3%
Adjustments — None	
Efficiency gain 1975 - 1985	25.4%
Total gain 1975 - 1986	25.1%

**Industrial Minerals Industry
Energy Use**

Type	Units	Petajoules	Percentage of Total Consumed			
			1986	1985	1984	1983
Natural Gas	912,107,015 m ³	33.167	40.1	42.6	45.8	44.7
Electricity	3,613,720 MWh	12.997	15.7	15.6	15.6	15.0
Liquid Petroleum Products						
Distillate Oil	14,331 kilolitres	0.547	0.7	1.2	1.1	1.2
Residual Oil	84,017 kilolitres	3.507	4.2	5.1	6.5	9.9
Diesel and Gasoline	40,817 kilolitres	1.614	2.0	2.2	2.9	3.7
Coal	9,410,903 tonnes	30.210	36.6	32.4	26.8	24.5
Other Fuels						
Propane and LP Gas	9,532 kilolitres	0.250	0.3	0.2	0.3	0.2
Steam	n/a	.340	0.4	0.5	0.5	0.6
Other	n/a	—	—	0.2	0.5	0.2
Totals	1986	82.632				
	1985	80.081				
	1984	79.213				
	1983	74.291				
	1982	84.229				
	1981	100.403				
	1975	103.450				

**Industrial Minerals Industry
Sector Energy Consumption**

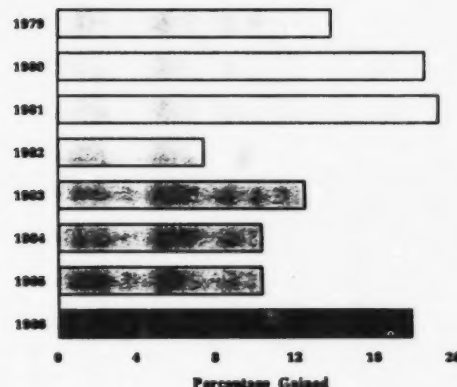
Sector	1986 Consumption Petajoules	Operating Efficiency			Base Year
		1986	+ 1985 =	T.T.D	
Abrasives	2.287	1.26	7.72	8.98	1982
Asbestos	4.528	2.70	5.81	8.51	1979
Cement	43.535	-2.05	26.35	24.30	1974
Clay Brick	3.589	2.34	24.93	27.27	1976
Concrete Products	0.548	2.21	12.05	14.26	1979
Glass	18.425	0.84	33.20	34.04	1974
Lime	5.113	2.28	13.48	15.76	1979
Miscellaneous	3.800	2.04	8.67	10.71	1977
Refractories	0.807	4.45	6.70	11.15	1974
Totals	82.632	-0.28%	25.40%	25.12%	1975



Machinery Industry

Energy Conservation Task Force

Arnold W.D. Garlick
Chairman



Task Force Description

The Machinery Industry Energy Conservation Task Force operates under the auspices of the Machinery and Equipment Manufacturers' Association of Canada (MEMAC). MEMAC membership is comprised of companies engaged in the production of a wide range of industrial machinery and equipment required by Canada's resource, processing, manufacturing and service industries, excluding farm and industrial equipment covered by the Canadian Farm and Industrial Equipment Institute. The industry's typical products include conveyors, mining machinery, equipment, valves, etc.

Activities of the task force are coordinated by the Energy Conservation Committee of MEMAC. This committee is chaired and administered by MEMAC and during 1986 had only one representative from an industrial sector because of several retirements. He was from Dominion

Engineering Works, a division of Canadian General Electric Company Limited.

The survey covered 111 MEMAC members and eight non-members with a response rate of 24.4% (29 companies). This was down from the 33.3% of the previous year. This drop in the response rate can be attributed to factors other than a decline in emphasis on energy conservation.

General Performance and Progress

The update of base year to 1985 was positively received by all participating companies. The 1986 response group produced an improvement of 7.5% from 1985 to 1986. While this figure is probably close to what was achieved, there is continued concern about the accuracy of the results because of the difficulty in measuring comparative units of production. The 1985 sample group pro-

duced an improvement of 10.4% over the period 1975 to 1985 and, adding the 7.5% for 1986, provides a total improvement of 17.9% to date. The machinery industry has already surpassed its 1990 target figure of 15%.

Savings as a result of conservation were approximately \$350,343 in the 1985 to 1986 period.

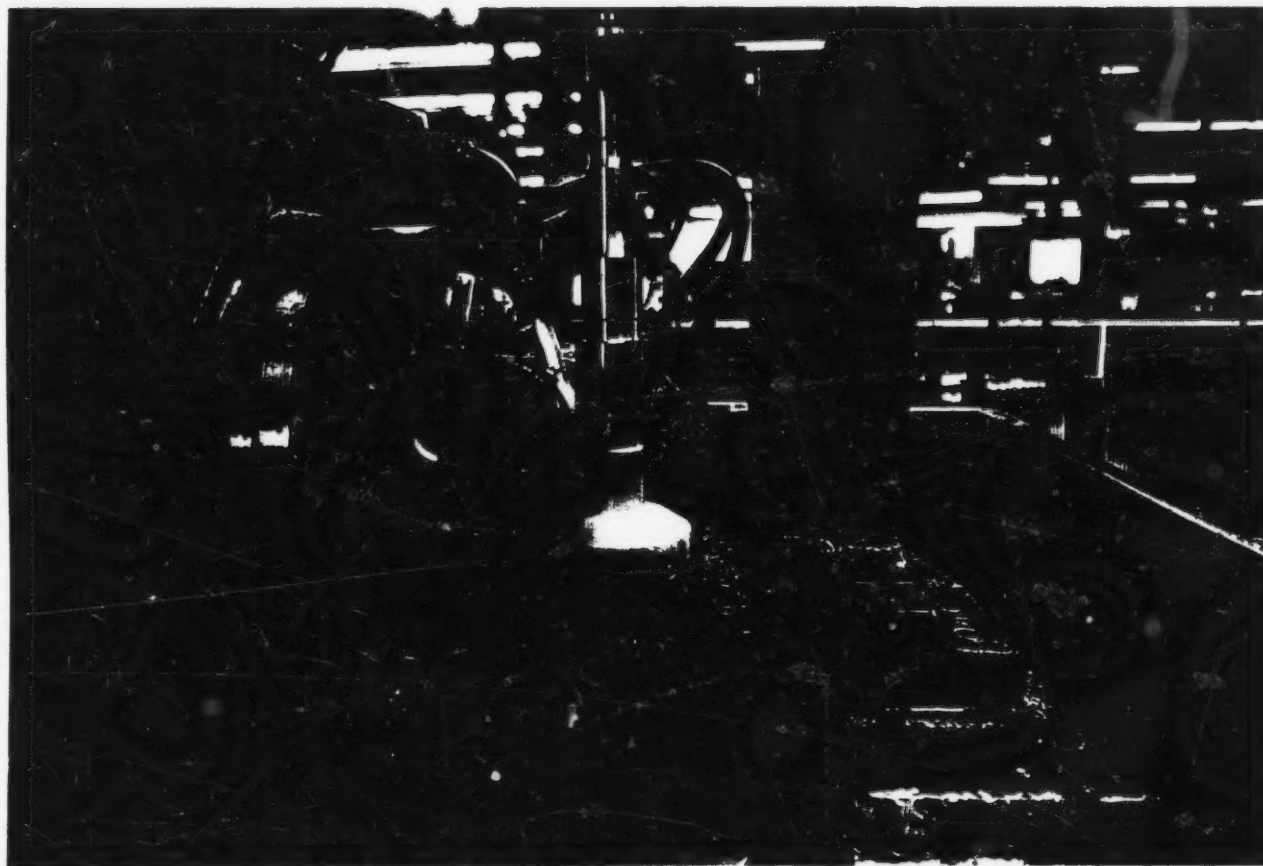
Not only are member companies implementing energy conservation measures in their plants, they are also making efforts to design their products for enhanced energy efficiency. Many companies are becoming very sophisticated in their methods to control energy costs.

Task Force Activities

The task force will undertake a review of the data provided by reporting companies to gain a better under-

standing of the results. In particular, an attempt will be made to more accurately reflect the impact of the changing processes and product-mix on the industry's results.

In addition to working within the CIPEC program the task force will continue to promote energy conservation initiatives of the Ontario Ministry of Energy and Québec ministère de l'Énergie et des Ressources.

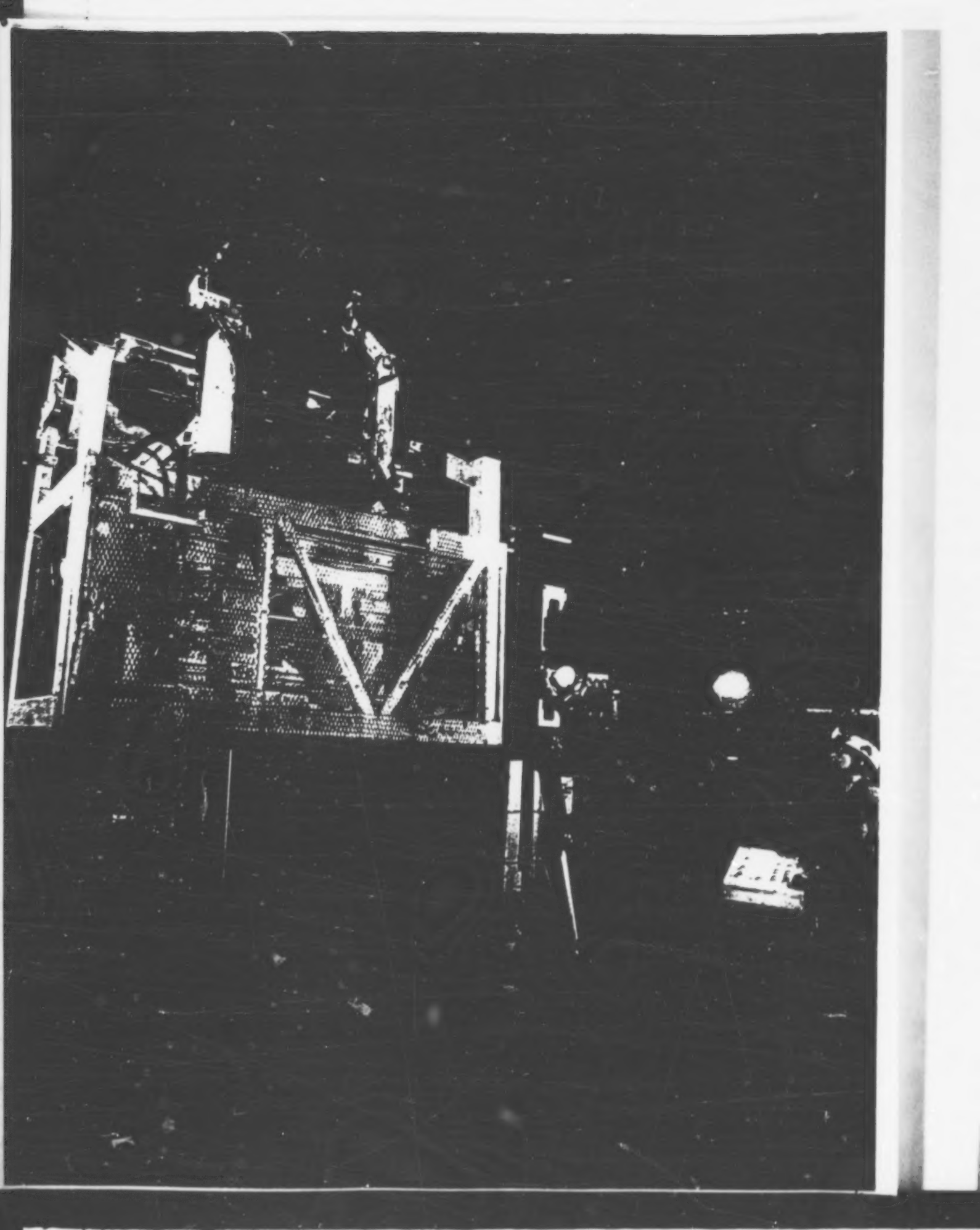


**Machinery Industry
Energy Efficiency Improvement**

Current year (1986) total energy inputs	564,661 gigajoules
New base year (1985) equivalent energy inputs	610,338 gigajoules
Net Improvement =	7.5%
Adjustments — None	
Efficiency gain 1975 - 1985	10.4%
Total gain 1975 - 1986	17.9%

**Machinery Industry
Energy Use**

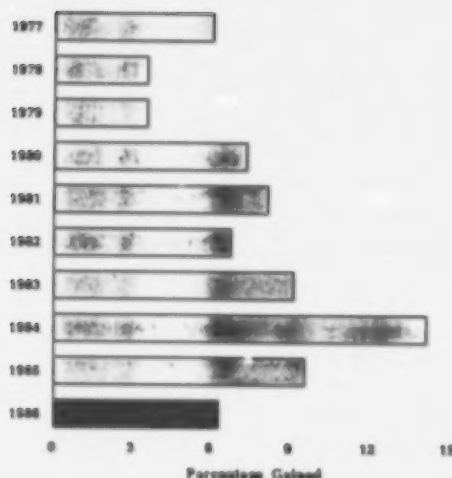
<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>Percentage of Total Consumed</u>	
			<u>1986</u>	<u>1985</u>
Natural Gas	8,600,178 m ³	319,927	56.7	56.4
Electricity	56,355,682 kWh	202,880	35.9	34.9
Liquid Petroleum Products				
Distillate Oil	778,159 litres	30,348	5.4	6.8
Diesel	16,900 litres	674	0.1	0.1
Gasoline	153,282 litres	5,549	1.0	0.7
Other Fuels				
Propane and LPG	2,963 kilograms	5,283	0.9	1.1
Other Gaseous Fuels	192,990 litres			
Total		564,661		



Mining and Metallurgy Industry

Energy Conservation Task Force

Raynald Fournier
Chairman



Task Force Description

The Mining and Metallurgy Energy Conservation Task Force was organized in 1975 and is operated under the auspices of The Mining Association of Canada. Its membership is comprised of major Canadian producers of a wide variety of minerals, including coal and metals such as copper, iron, nickel, lead, zinc, aluminum, gold, silver, and molybdenum. Included are all phases of operations such as mining, milling, smelting, and refining.

Nine companies participated in the 1986 survey and these represent an estimated 70% of the total energy usage in the mining industry.

Activities of the task force are directed and co-ordinated through an annually elected chairman, as well as a representative from The Mining Association of Canada (MAC). For 1986, the chairman was Raynald Fournier of Quebec Cartier Mining

Company, with A. Hugh M. Jones as the MAC representative.

Progress and Performance

To the end of 1985, energy consumption per unit of production showed an adjusted reduction of 9.6% from the base year 1973. The best year was 1984 with an improvement of 14.2%. Although the task force fell somewhat short of its goal of 15% improvement by the end of 1985, many of the member companies exceeded that mark.

Due to the closure of certain operations and the creation of new ones, the base year of 1973 is no longer applicable. In addition, some of the newer members do not have records that go back to that year. For these reasons the task force decided to adopt 1985 as the new base year and pre-1986 performance statistics have been adjusted to reflect this.

The total 1986 energy usage by the reporting members was 89,796 terajoules. This is equivalent to the energy content of 14.6 million barrels of oil. The 1985 base year equivalent was 85,866 terajoules. The overall industry performance (adjusted for such factors as weather, changes in ore, and changes in product, etc.) was -3.3%. This small slippage in efficiency (1985 to 1986), is a continuation of the trend that began in 1984. The primary reason is the downward trend in energy costs since 1984.

Another reason for the negative performance is the change in the base year. It was easy to show an improvement over 1973 as the industry was still relatively inefficient at that time. On the other hand, the mining industry made significant improvements in efficiency prior to 1985 and as such it represents a time of relatively high efficiency. Maintaining that is somewhat more difficult.

One other factor that could have affected the performance is that fewer companies reported in 1986 than 1985.

Energy Distribution

In 1986, petroleum represented 24.3% of the energy usage. This is up slightly from 1985 and reflects the drop in oil prices during 1986. The overall trend since 1979 has been one of decreasing petroleum consumption which is consistent with the federal Government's "off-oil" policy.

Petroleum is being replaced primarily by natural gas. Natural gas accounted for 22.2% of the energy used in 1986, down slightly from 1985 but still double the percentage used in the 1970's. Further increases will be limited because natural gas is unavailable to many mining locations.

Coal and coke have also replaced oil in some areas. Combined, they now account for almost 12% of the energy used, having increased a little every year since 1980, when they represented only 4.5%.

Electricity remains the major energy source, hovering around the 40% mark. No changes in this trend are expected.

Figure 1 illustrates the changes in energy distribution for the mining and metallurgy industry from 1985 to 1986.

Task Force Activities

During the past year, the member companies held three general technical meetings to exchange information and share expertise on energy management. Two of these meetings were hosted by member companies — INCO in Sudbury, Ontario, and Noranda at the Research Centre in Pointe Claire, Quebec. Both meet-

ings were followed by tours of the respective facilities.

Two provincial government representatives joined the task force this year: Richard Fry of the Ontario Ministry of Energy, and Robert Thibeault of Quebec's Bureau des économies d'énergie. Both gentlemen gave presentations of their provinces' energy programs.

The task force continues to maintain a "Manual of Case Histories" which describes recent energy management activities carried out by the member companies. During 1987 the standard format for recording case histories will be reviewed to facilitate easier information retrieval.

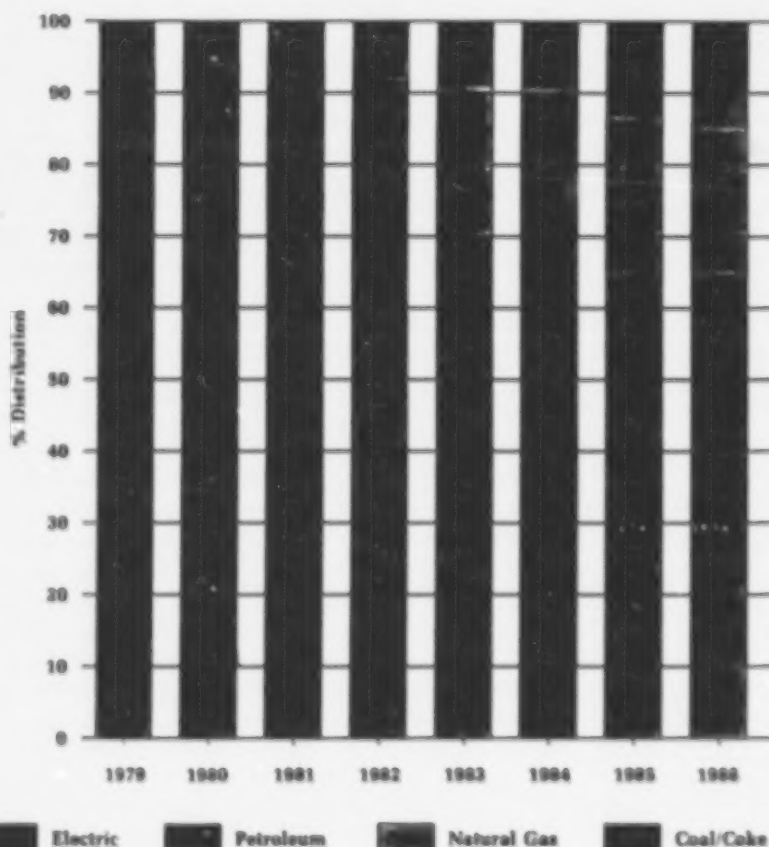
Future Outlook

It is expected that petroleum prices will increase in the near future. This, coupled with the fact that base metal prices are low at present, should rekindle the desire to become more energy efficient. Companies are having to lower their production costs in the face of increasing off-shore competition.

Rising oil prices should again cause a decrease in the use of petroleum products, with natural gas and coal finding increased use.

Figure 1

Mining and Metallurgy Industry Historical Energy Distribution

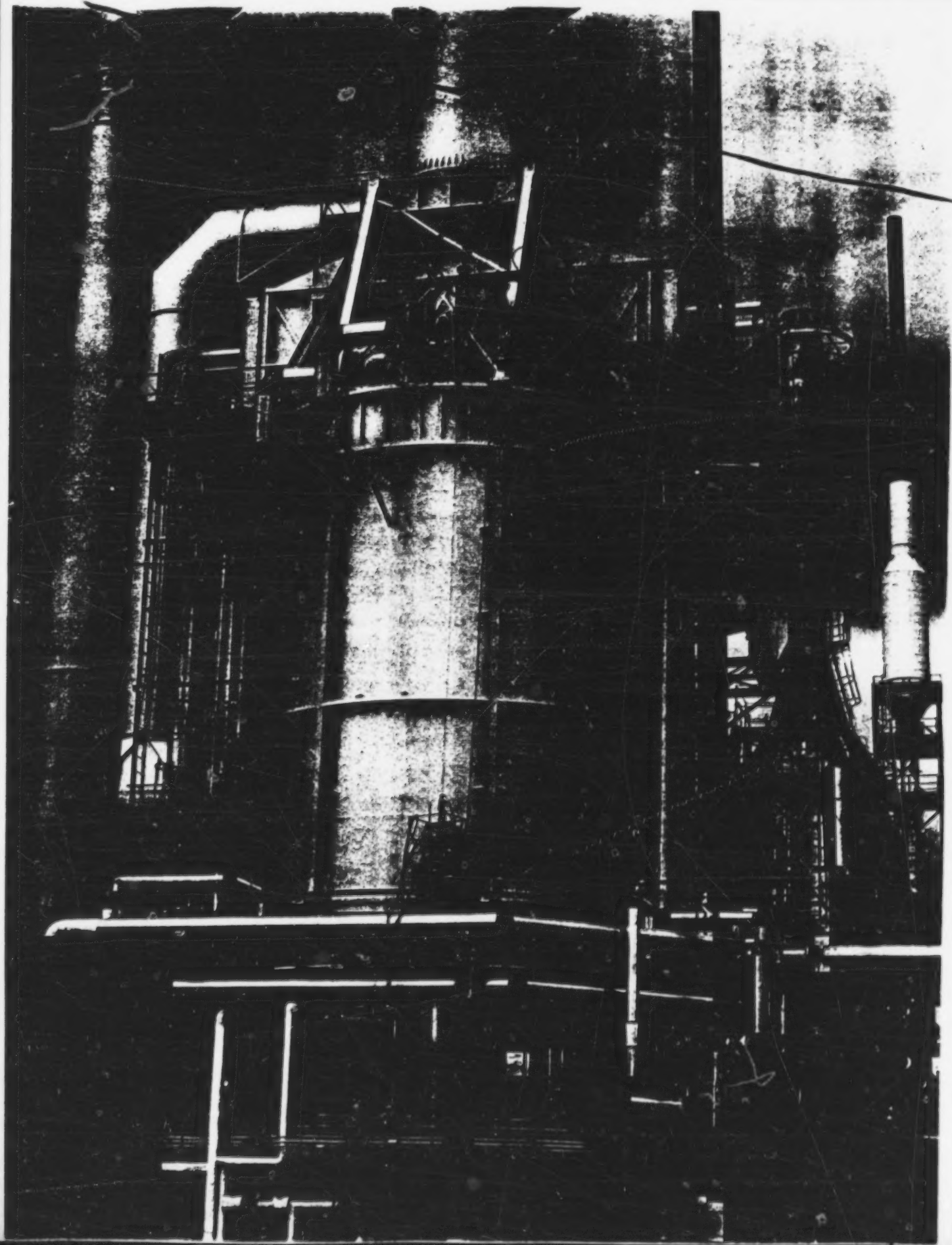


Mining and Metallurgy Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	89,796 terajoules
New base year (1985) equivalent energy inputs	85,866 terajoules
Gross improvement =	-4.58%
Adjustments	1,061 terajoules
Adjusted base year equivalent	86,927 terajoules
Net improvement =	-3.3%
Efficiency gain 1973 - 1985	9.6%
Total gain 1973 - 1986	6.3%

Mining and Metallurgy Industry Energy Use

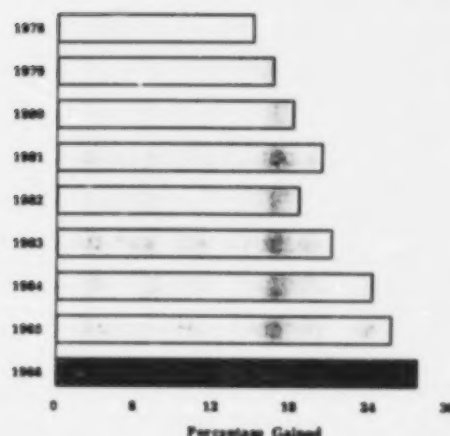
Type	Units	Terajoules	Percentage of Total Consumed	
			1986	1985
Natural Gas	536,810,000 m ³	19,970	22.2	23.1
Electricity	10,030,600 MWh	36,110	40.2	41.2
Liquid Petroleum Products				
Distillate Oil	101,880,000 litres	3,941	4.4	0.8
Residual Oil	336,025,013 litres	13,969	15.6	15.7
Diesel	92,947,839 litres	3,595	4.0	6.2
Gasoline	7,170,339 litres	309	0.3	0.8
Coal	180,133 tonnes	4,392	4.9	4.9
Coke	208,166 tonnes	6,287	7.0	5.0
Other Fuels				
Propane	30,260,902 litres	1,092	1.2	2.1
Other	n/a	131	0.1	0.2
Total		89,796		



Petroleum Refining Industry

Energy Conservation Task Force

G.G. Myers
Chairman



The Petroleum Refining Industry Task Force was established in April 1977 and represents eight of the 12 Canadian refiners which process about 90% of the industry throughput. Since 1984 Syncrude's upgrading plant has been included in the refining statistics.

Energy Efficiency Improvement Progress

The petroleum refining industry energy consumption in 1986 was 27.6% lower than in 1972 base year when adjusted to an equivalent operating intensity. Improvement from the previous year was 2.0%. The reduction of 27.6% corresponds to an annual savings in the order of three million cubic metres, which is equivalent to about 15 days of oil consumption in Canada.

The refining processing intensity was much higher in 1986 than in the 1972 base year due to a number of factors such as lead phasedown,

tighter product sulphur specifications and product-mix changes. Without adjustment for the increased severity of operations, actual energy use per unit of throughput was 12.3% lower in 1986 than in 1972.

Economic Factors Affecting the Industry

The large drop in world oil prices severely reduced funds for capital expenditure and lowered the expected returns on potential energy conservation projects. However, increased emphasis has been placed on operational efficiencies in the general need to reduce costs.

Specific Conservation Activities

(1) Operations and Maintenance

Much of the improvement achieved in 1986 was the result of continued improvement in operation and maintenance of

processing equipment. Areas of improvement included:

- management, leadership and supervisory attention
- enhanced operating and maintenance personnel awareness and programs leading to quicker identification and correction of energy inefficiencies
- faster response to maintenance of steam leaks, damaged insulation, steam traps, exchanger cleaning, etc.
- optimization of steam systems
- improved energy monitoring and control
- engineering studies related to process optimization
- reduction in crude and product losses

(2) Capital Projects

Some capital expenditure for energy conservation proceeded in spite of reduced funding available. Examples include:

- process heat recovery facilities
- plant automation improvement
- insulation upgrading
- improvements to reduce steam consumption
- furnace thermal efficiency improvements

- data management systems
- high efficiency motors
- on-line analyzers
- flare measurement and recovery

A high proportion of the above equipment is designed and manufactured in Canada.

Task Force Activities

The task force is directed by two committees, a Steering Committee which sets policy, maintains government relations and establishes funding, and a Technical Committee which reviews the industry reporting procedures and generates industry data.

The Steering Committee chairmanship passed from R.W. Hodgson to G.G. Myers and N.J. Little accepted the chairmanship of the Technical Committee.

The offices and secretarial services of PACE (The Petroleum Association for Conservation of the Canadian Environment) are used for consolidation of the energy consumption statistics of the individual companies. This provides a means for individual companies to submit

accurate data while still maintaining company confidentiality.

It is important to recognize that the time, people resource, and costs involved in executing the activities of the task force are borne by the petroleum industry.

This sector does not consider itself to be the proper vehicle for conducting educational workshops and seminars. However, we encourage member companies to participate in academic and industrial seminars on energy management and conservation.

Future Outlook

In the near term, strong emphasis is being placed on further developments in operating and maintenance practices and the application of modern technology. This includes improved monitoring of energy consumption.

In the longer term, increased capital expenditures will be required to achieve further significant progress.

Technological innovation will continue to contribute strongly to energy conservation.

(3) Technology Improvements

Petroleum refining is a technology-intensive industry, with continuing opportunities for innovation. Considerable applied research and development is being done in Canada and the industry also maintains close ties with the scientific and technology community worldwide. Application of this R&D and worldwide experience is contributing to improvements in energy utilization and energy self-sufficiency in Canada. This holds promise for future progress. Some examples of new technologies employed are:

- improved catalysts
- new approaches to heat integration
- advanced computer control systems

Petroleum Refining Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	262.9 petajoules
New base year (1985) equivalent energy inputs	267.0 petajoules
Gross Improvement = 1.6%	
Adjustments (product mix, environmental, processing complexity, utilization)	1.3 petajoules
Adjusted base year equivalent	268.3 petajoules
Net Improvement =	2.0%
Efficiency gain 1972 - 1985	25.6%
Total gain 1972 - 1986	27.6%

**Petroleum Refining Industry
Energy Use**

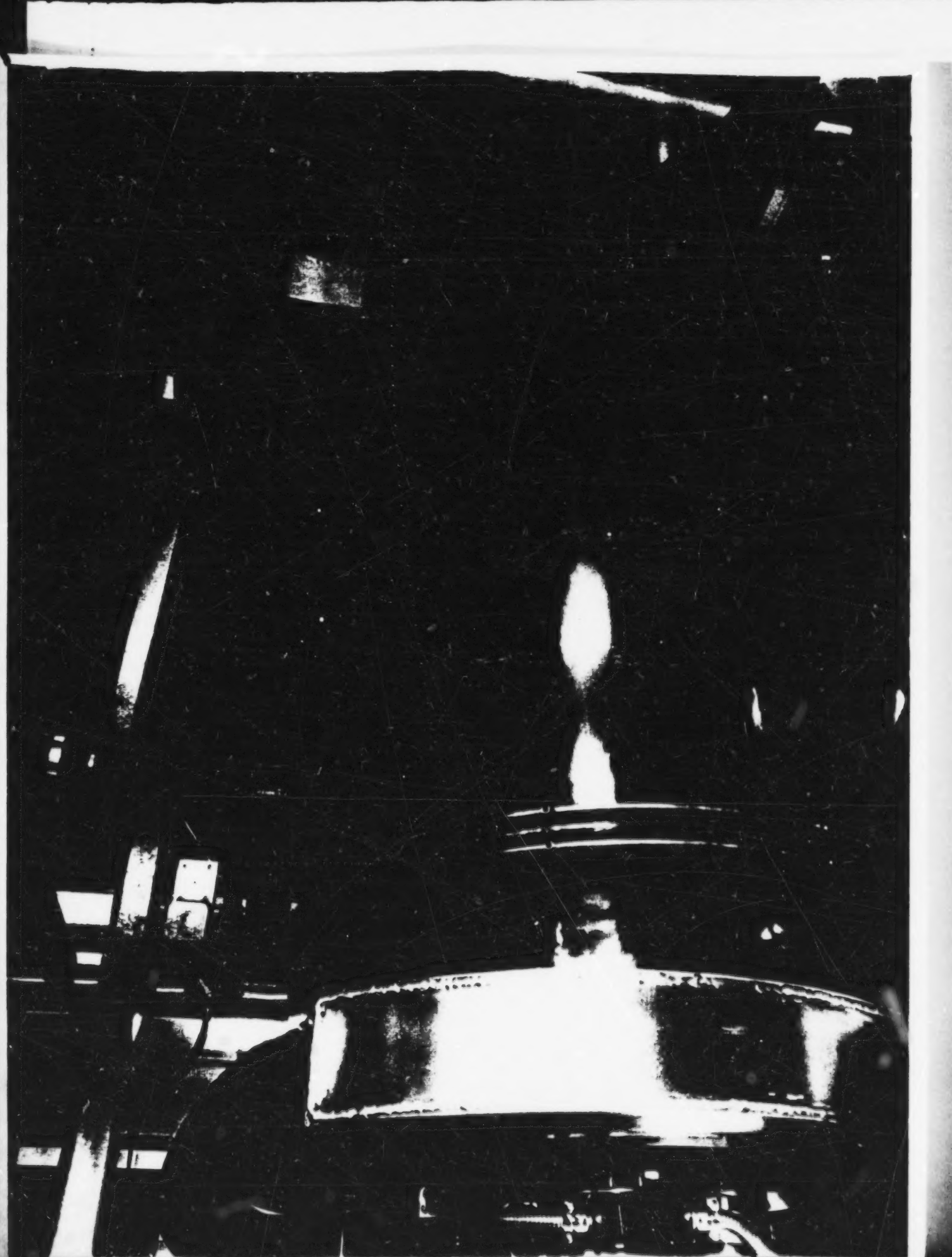
<u>Type</u>	<u>Terajoules</u>	<u>Percentage of Total Consumed</u>
		<u>1988</u>
Natural Gas	44,165	16.8
Electricity (purchased) (a)	38,118	14.5
Liquid Petroleum Products		
Distillate Oil	—	—
Residual Oil	23,397	8.9
Petroleum Coke	49,160	18.7
Other Fuels		
L.P. Gas	1,840	0.7
Refinery Gas	104,629	39.8
Steam (purchased)	1,577	0.6
Total	262,886	

Percentage based on (1) company assigned values, (2) measured thermal values,
or (3) values normally used by the U.S. Bureau of Mines as follows:

Applied Conversion Factors

Crude Oil	37.660 GJ/m ³
Distillate	38.655 GJ/m ³
Residual	41.721 GJ/m ³
LPG	26.617 GJ/m ³
Natural Gas	38.414 MJ/m ³
Refinery Gas	36.886 MJ/m ³
Petroleum Coke	35.030 MJ/kg
Coal	27.935 MJ/kg
Purchased Steam	2.791 MJ/kg

(a) Purchased electricity assigned a value of 10,551 kJ/kWh

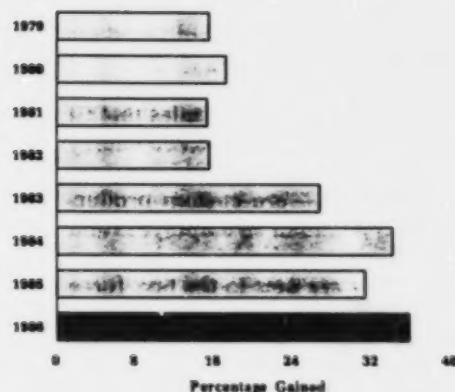


Plastics Processing Industry

Energy Conservation Task Force

Dr. R. Maraghi
Chairman

R. Hayter
Co-Chairman



Industry Profile

For the past 20 years the plastics processing industry has been the fastest growing manufacturing sector in Canada with annual growth rates averaging 2.7% greater than the national real GDP. With 77,600 employees and \$9.5 billion GDP, this industry is now the fourth-largest manufacturing sector.

The industry consists of over 2000 companies engaged wholly or partly in the production of plastic materials and additives, in processing them into semi-finished and finished products, and in the making of plastics processing machinery, moulds and dies.

This report covers only those moderately sized processing firms that are independent from the large integrated manufacturing industries. For example, the automobile manufacturers, electrical and electronic industry, chemical companies, etc., all have large plastic processing

operations but report their consolidated efficiencies to other task forces. The report also does not include manufacturers of plastic processing equipment, sales and warehousing firms, or many of the companies that are too small to be concerned about formal energy management programs.

The Society of the Plastics Industry of Canada (SPI) serves as host organization for the processors' energy management task force and co-ordinates the survey returns — 46 in 1986.

Different energy management concerns and capabilities exist throughout this industry as a result of the variation in company sizes, number of employees, and the length of time that each has been in business. For example, 10% of the respondents had annual sales of \$10 to \$50 million and usually produce high precision products in long runs on a three shift, five-to-seven day schedule. Energy costs in these companies vary between \$1 and \$3 million.

Most have long-established energy management programs with responsibilities assigned to plant engineers or production managers. Saving energy costs through deregulated natural gas contracts was one of the main items for management attention in 1986. In the larger companies, operating environment, statistical quality control techniques, quick die changing procedures, and "Just-in-Time" (JIT) production techniques are applied for overall production and energy efficiency. Many of these companies show energy improvement gains in the 30% to 40% range from reference periods in the middle 1970's.

About 65% of the reporting companies have energy costs between \$100,000 and \$1 million each year. These companies display a variety of energy-related activities, i.e., have had the government's free audit examinations, have previously installed common heat recovery apparatus, normally operate electrical

systems within acceptable power and load factor ranges (or are still installing equipment for automatic control), have upgraded HVAC and insulation systems, etc. Energy monitoring capabilities range from detailed cost accounting of monthly utility billings to on-line computerized manufacturing information systems. In this category, performances are somewhat mixed as a result of the effects of different energy conservation retrofit projects and business activities.

The majority of companies that fit into the \$50,000 to \$100,000 energy cost category — 25% of this report's participants — are custom producers with less than 30 employees and management staff. Many of these companies are new to the task force monitoring activities and report different efficiency gains from different reference periods. In fact, six companies reported for the first time in 1986 with only nominal gains from the new 1985 base year period. Energy management usually consists of utility bill cost accounting and routine maintenance of equipment. It is not uncommon to find companies of this size renting factory floor space and therefore not always in control of all utility costs. Tracking the efficiencies of energy use are particularly difficult when most of the products are custom-made or have short production runs.

Energy Performance

Total energy utilization in the 46 participating companies improved 4.35% in 1986, raising the overall gain since 1980¹ to 35.85%.

Fuel and electricity cost the participating companies about \$23 million during the year, but because of the operating efficiency gains, nearly \$1.4 million in manufacturing expenses was avoided.

Factors Impacting on 1986 Performance

The main factors contributing to higher efficiency in the past few years have been due to the tremendous increase in production volumes, operation at peak capacity utilization rates, constant introduction of modern manufacturing equipment, and implementation of specific energy conservation improvements within the plant buildings. These contributing factors prevailed throughout 1986.

In 1986, according to Statistics Canada, production rose 4.8% while the value of these shipments went up 9.3%. Indeed, as confirmed in an SPI business survey, three-quarters of the companies registered significant increases in profits which, invariably, are used for business modernization and expansion.

The 4.35% energy improvement rate, while still one of the highest in the manufacturing industry, is not as great as previous years when 5.5%, 5.9%, and 5.3% gains have been registered. This slowing trend is certainly an indication of fewer perceived energy conservation opportunities — partly as a consequence of softer energy prices and the recent deregulation of natural gas contracts which have injected a much needed competitive pricing structure into the energy market place. Even though retrofit paybacks have been somewhat lengthened because of the slower energy price increases, one-third of the participants mentioned that capital energy conservation projects are scheduled for 1987, with payback periods between 1.5 to 3 years considered acceptable.

For the fourth consecutive year, new investment in the plastics processing industry (SIC major group 165) was at record levels. Even though it is thought that Statistics Canada figures cover only about one-half of the total industry spending (because of the existing system of classification), \$189.4 million was

reported to be the level of investment in new machinery and equipment while \$35 million was spent on new capital facilities. This level of investment is an increase of 10% over amounts spent in 1985.

Energy retrofit projects are becoming more complex to implement in the plastics processing industry due to the basic nature of the operation. From previous industry energy audit results, most of the energy conservation opportunities come from recovery of waste heat from ventilation systems, air compressors, boiler blowdowns, etc. Even if expensive heat pumps and air-to-air exchangers were used to recover this low-grade waste heat, there are few suitable places where it can be reused. However, some ingenious ways are still being found to lower consumption. Minimizing warm-up times and optimizing hydraulic system pressures are typical examples.

Another industry trend that decreased energy consumption pertains to the gradual reduction of warehousing space. Recent studies show that the turnover of inventories relative to production volume rose from 1.5 to 1.8 in 1986, partly as a result of the "Just-in-Time" production scheduling techniques used by customers and processing companies themselves. Some of the 16% of space saved is no doubt being used for production instead of storage.

Future Outlook

Extensive R&D activities with new materials and processing techniques are also paying off in reduced energy consumption, not only in the industry companies themselves, but also for the general public. Plastic products invariably cost less to process and require less energy compared with traditional materials. The plastic grocery bag, plastic liquid container, and extruded piping, are typical examples of how the functionality of polymer materials has been

¹ Even though the Plastics Processing Energy Conservation Task Force was established in 1976, the consolidated reference time has gradually shifted up to 1980 as a result of constant changes in products.

substituted for other common materials. Experts predict that the automobile at the turn of the century will be made essentially from non-corrosive plastic components.

New blends with enhanced properties are constantly being developed to provide even more general uses — all with less total energy consumption.

With steady growth in product demand, continued high levels of investment in modern equipment, aggressive application of leading-edge technologies, and maturing energy management techniques, the future of still greater unit-energy savings is exceedingly bright. The 1990 task force conservation target of 50% improvement over the operating stand-

ards experienced in 1980 will most likely be surpassed.

Energy Use Patterns

The distributions of the different sources of purchased energy are shown for the past five years. The shares of electricity and natural gas, 42.5% and 53.0% respectively, are about the same as they were five years ago. However, the figures do not reflect the minor fuel conversion projects that are still occurring, particularly in Quebec where electricity is being used more extensively for heating because of the attractive prices provided by Hydro-Quebec.

In other regions, cost savings are being realized through competitive

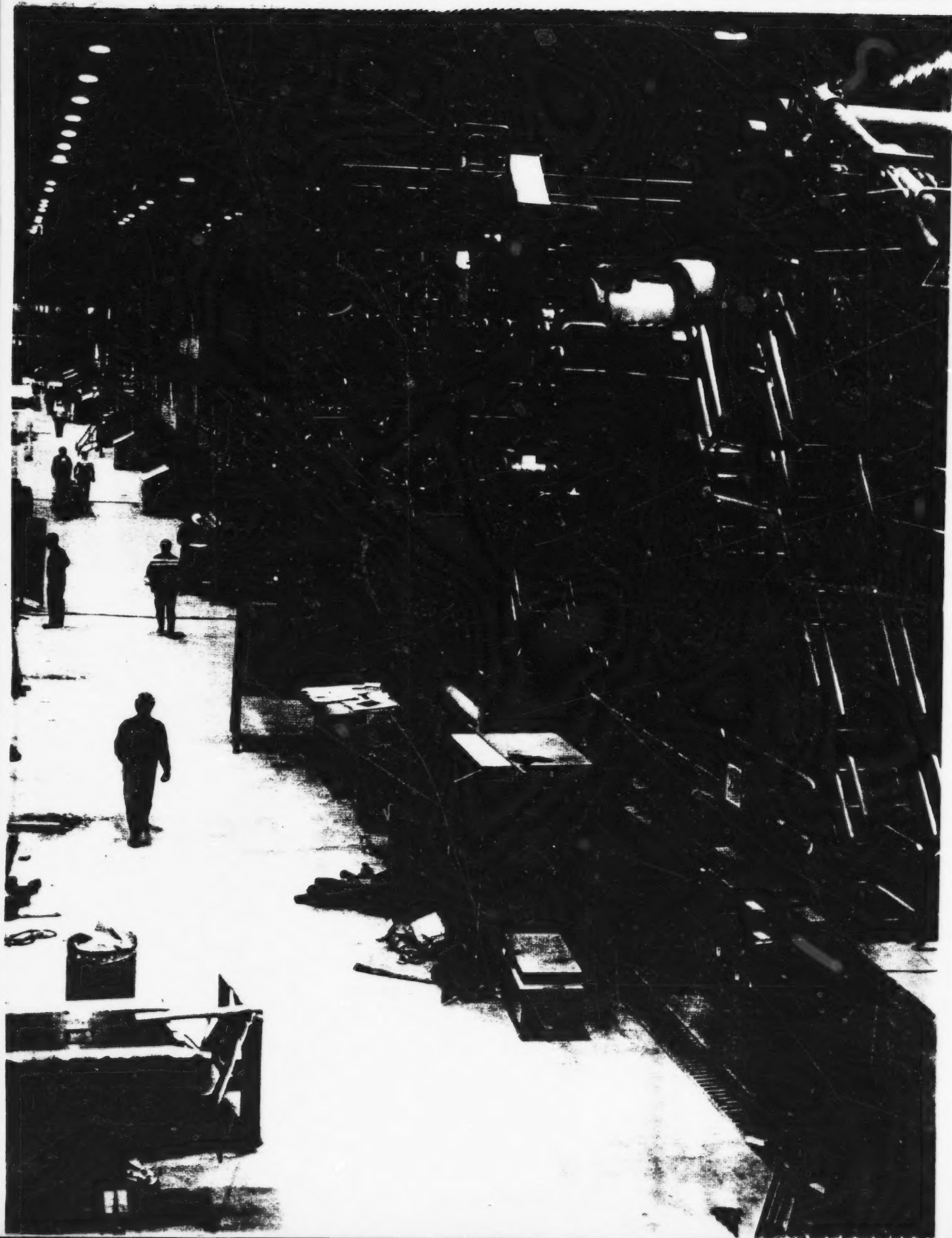
marketing of deregulated natural gas contracts. While this activity does not always result in detectable changes in consumption patterns, it nevertheless requires closer attention to gas contract limits and temporary switching to fuel oil or propane. One-half of the 1986 survey respondents had natural gas costs above \$100,000 per year. This is about the level where it becomes worthwhile for a company to commit the resources necessary for negotiation and management of these complicated deals. A small increase in fuel oil consumption in the past three years could be the result of switching to take advantage of the low prices of fuel oil.

Plastics Processing Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	2,944.8 terajoules
New base year (1985) equivalent energy inputs	3,078.9 terajoules
Net Improvement =	4.3%
Adjustments — None	
Efficiency gain 1980 - 1985	31.5%
Total gain 1980 - 1986	35.8%

Plastics Processing Industry Energy Use

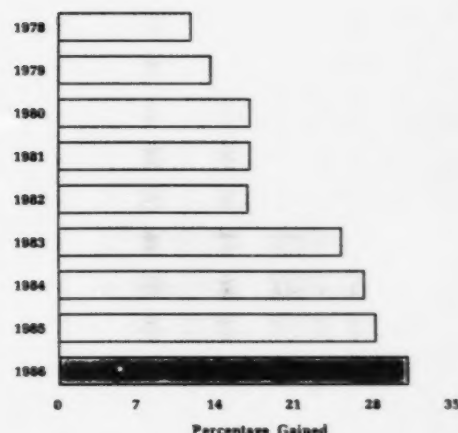
			Percentage of Total Consumed				
Type	Units	Terajoules	1986	1985	1984	1983	1982
Natural Gas	41,986,696 m³	1,561.9	53.0	51.4	51.5	49.8	53.9
Electricity	347,219 MWh	1,250.0	42.5	43.2	44.7	48.8	43.5
Liquid Petroleum Products							
Distillate Oil	739,512 litres	28.8	1.0	1.1	0.7	0.6	1.3
Residual Oil	2,211,215 litres	89.4	3.0	3.5	2.8	0.4	—
Diesel	129,939 litres	2.6	0.1	0.6	—	—	—
Gasoline	62,519 litres	2.3	0.1	—	—	—	—
Other Fuels							
Propane	369,845 litres	9.8	0.3	0.2	0.3	0.4	1.3
Total		2,944.8					



Pulp and Paper Industry

Energy Conservation Task Force

H.D. Paavila
Chairman



Sector Description

The Canadian Pulp and Paper Industry Energy Monitoring Report covers 127 mills accounting for about 98% of the total pulp, paper and paper-board produced in Canada in 1986. Seven of the mills included in the report are not members of the Association. A total of 65 companies participated in the survey.

Progress Toward Improved Energy Use Efficiency

In 1986 the Canadian pulp and paper industry used 31.1% less purchased energy per ton of product than that used in the base year 1972. This continuing improvement in energy use efficiency is in part attributable to the record operating rate achieved by the industry. Production increased by 27.7% over the base year.

The trend of diminishing reliance on fossil fuels reported in last year's

report continues. The major energy source is now purchased electricity which accounts for 47.5% of the total purchased energy. Heavy fuel oil has shrunk to 22.4% of the total, which is 31% of the amount used on an equivalent production basis in 1972. On a unit energy basis, electricity increased due to electric boilers in Quebec and increased motive power requirements of mechanical pulping processes which are gradually replacing sulphite pulps, especially in the newsprint sector.

The reduction in heavy fuel oil use is equivalent to 3.67 billion litres and, in total purchased energy use, is equivalent to 3.37 billion litres of heavy fuel oil in 1986.

Operating Conditions

As noted above, production for the year 1986 was a record one for the industry. Shipments of pulp and paper by the Canadian industry rose by 7% over 1985, with printing and

writing grades showing the largest increase. The industry as a whole operated at 94% of capacity for the year, with only insignificant losses of production due to work stoppages. In the second half of the year it ran virtually at full capacity. Accompanying this increased output, profits improved significantly. Nevertheless, given the large number of modernization, productivity improvement, and quality improvement projects which have been "on hold" because of poor cash flows over the past several years, and the more modest fossil fuel prices which are currently applicable, energy conservation projects will continue to be given lower priority than in the late 1970's.

Replacement of fossil fuels with wood wastes generated by the industry and neighbouring wood products operations, moved forward modestly in the past year. These wood wastes now account for 67% of the total fuels burned by the industry.

Waste fuels plus captive hydraulic power account for 56% of the total energy used, up from 40% in 1972.

Technological Developments

The Gatineau, Quebec, mill of CIP Inc. was awarded CPPA's Technical Section Energy Conservation Opportunity Award in 1986. A "Lotus 1-2-3" spread sheet software program was used to optimize the generation rates of a number of steam generating units using a diverse fuel supply, namely, electricity, natural gas, oil and bark. Through the optimization program the best combination of fuels was selected, resulting in a saving of \$230,000 per year in total fuel cost. No capital expenditure was required for this project.

The Technical Section's energy conservation awards program has now generated a total of 358 case studies, which have been published for distribution throughout the Canadian industry.

In a partly government-funded project at Paprican, computer simulation is used to explore the potential energy benefits of installing a

steam generating, high-temperature heat pump (HTHP) in newsprint mills. The systems considered are (a) heat pumps with freon-R114 as the working fluid with subsequent mechanical compression of low pressure steam to make it suitable for use, e.g., in the dryers, and (b) freon-R113 heat pumps, which could be operated at higher temperatures and steam pressures and thus used without any need for subsequent steam compression. Thermal stability data indicate that R113, not yet in commercial use, can be exposed to a HTHP environment up to about 140°C if the system comprises a refrigerant turbocompressor that does not allow mixing of the refrigerant and the lubricating oil, common in many systems.

The case studies showed that with a steam cost of \$5/GJ (i.e., US\$20/barrel oil) and an electricity cost of 2 cents/kWh:

- (a) an R114 HTHP (capital investment Can\$5.5 million) producing about 40 GJ/hr of steam at 140°C and a COP of 2.77, could result in an after-tax discounted-cash-flow return-on-investment

of 12%, with a payback period of 5.6 years and,

- (b) an R113 HTHP (capital investment of Can\$4.7 million) producing about 46 GJ/hr of steam at 140°C and a COP of 2.83, could result in an after-tax DCF-ROI of 18%, with a payback period of 3.7 years.

Currently, a second mill is being studied where, with sufficient supply of high pressure steam, the use of an R114 HTHP in combination with a steam-jet thermocompressor would be feasible. This should lower the total capital investment and make the use of R114 heat pumps competitive with the R113 HTHP, with the advantage of using a proven system.

The Future

The Canadian Pulp and Paper industry's energy conservation target for 1990 is a 33% reduction in purchased energy per ton of product, compared with 1972. It is anticipated that this target will be met.

Pulp and Paper Industry Energy Efficiency Improvement

Current year (1986) total energy inputs	312.29 petajoules
Base year (1972) equivalent energy inputs	453.39 petajoules
Net Improvement =	31.1%
Adjustments — None	
Efficiency gain 1972 - 1986	31.1%

Survey Data

Number of companies in 1986 report	65
Number of plants in 1986 report	127
Approximate percentage of energy consumption covered in report	98%
Current year consumption	312.29 petajoules
Current year production	24,387,807 tonnes
Base year consumption (actual)	355.12 petajoules
Base year production	19,102,066 tonnes
Base year volume equivalent consumption	453.39 petajoules
1990 goal (relative to 1972 base year)	33%

Pulp and Paper Industry Purchased Energy Consumption

Type	1986** Petajoules	Percentage of Total	1985** Petajoules	Percentage of Total	1972* Petajoules	Percentage of Total
Natural Gas	80.74	25.9	77.82	26.1	91.44	20.2
Electricity (purchased)	148.42 ****	47.5	133.82 ***	44.9	109.04	24.0
Liquid Petroleum Products						
Distillate Oil	4.96	1.6	5.89	2.0	8.38	1.8
Residual Oil	69.97	22.4	70.21	23.6	223.35	49.3
Coal	5.97	1.9	8.5	2.9	15.75	3.5
Other Fuels						
L.P. Gas	0.73	0.2	0.60	0.2	0.75	0.2
Other	1.50	0.5	1.04	0.3	4.68	1.0
Totals	312.29	100.0%	297.88	100.0%	453.39	100.0%

*Reported on 1972 unit use adjusted to 1986 production

**Actual Use

***31.55 petajoules (10.6%) used in electric boilers

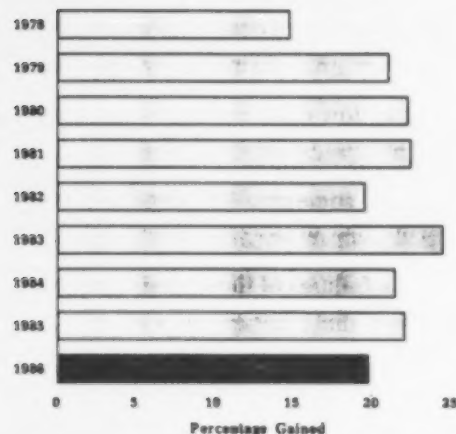
****33.75 petajoules (10.8%) used in electric boilers



Textile Industry

Energy Conservation Task Force

Luis G. Monton
Chairman



Changing Times

This report, covering energy management activities in primary textile manufacturing in Canada, reflects an industry in transition. As a result of ongoing changes, the so-called efficiency improvement calculation produces a very slight negative figure when measured against the previous year. Consumption of energy per kilo of product was 2.3% higher than the previous year. Seen against the 22.1% improvement in management efficiency over the first decade, as reported in 1985, the current reduction is given attention but not concern.

The Task Force

As one industrial task force in the Canadian Industry Program for Energy Conservation (CIPEC), the energy conservation committee of the Canadian Textiles Institute supervises its voluntary energy program. This ensures representation

by an estimated 86% of the industry, including all the major plants with high levels of energy consumption.

During the year under review the task force regrettably lost its chairman, J. Ed. Kelly, because of other commitments. Replacement did not take place until early in the current year (1987) when the chair was assumed by Luis G. Monton, president of Monterey Textiles, Inc., of Montreal.

The Industry and Transition

Primary textile manufacturing in Canada concerns itself with the production and treatment of fibres, yarns and fabrics, including bleaching, dyeing, finishing, printing and in some cases preparation of consumer products for the retail trade. The products supply Canadian homes and industry. Both science and fashion have increasingly dictated changes in the mix of products, lending distortion to measurement

of energy consumption per kilo of product. In the fashion field, the choice of consumers has moved sharply toward fabrics using natural fibres like cotton or spun fibres of rayon, both of which absorb and retain greater quantities of water than man-made filament yarns. In the "wet" processes: dyeing, finishing, washing, and drying, the energy needed is sometimes three to four times greater per kilo of product.

This is compounded by an increase in imports of greige (untreated) foreign fabrics which then go through these wet processes in Canadian plants. Thus more energy is used without any equivalent kilos of production being added to the efficiency calculation. Science also contributes to the change in product-mix. Items for use in industry, once about half the output of the mills, are now the dominant proportion, although not all the dramatic applications require similar large increases in energy per kilo. Geotex-

tiles from the chemistry laboratories allow man to build heavy duty runways on the tundra, geofabrics let water pass through in only one direction and *Kevlar* is the fibre used to produce the famous and much-publicized roof of Montreal's Olympic Stadium.

Capacity utilization is always a variable in an industry where production cutbacks are produced by waves of low-cost imports — more than half the Canadian market is in foreign hands. But the impact of this factor was somewhat less significant in 1986 than in previous years, one reason being that plant closings and business failures of those years have improved the total capacity of the industry.

Another consideration which would indicate a levelling of efficiency apart from the concerns cited above, is that at this point in energy history a good many of the major capital expenditures for improved conservation have already been made.

There continues a strong dedication in the industry to the principles of sage energy management though it must be admitted that in some quarters during the past year a danger of apathy in energy concerns may have been related to falling oil prices. Some reversal in that price trend seems now to reconfirm full-out concentration on energy management efforts.

Major changes in the product-mix were recognized last year as the source of misleading inferences about textile efficiency so the task force modernized its report and adopted 1984 as the base year for a second phase of the program. Since CIPEC has decided to follow that trend and recommends 1985 as the new base year, the textile group has again adjusted its 1986 calculation to this pattern.

Energy Changes

Some changes in energy sources occurred in 1986. Use of natural gas was off slightly as a proportion of the total consumption although it still represented nearly half of that total, 47.8%. Contrary to trends of the recent past, there was a noticeable increase in the use of crude oils due, undoubtedly, to the bargain prices that were briefly available. Consumption increased to represent 23.5% of the total energy used, a gain of more than eight percentage points over the previous year.

Electricity held its position, dropping only 1% from the 29.1% of total recorded last year.

Other energy forms, each relatively small in comparison, varied little, although propane at 0.1% of the total had apparently given way to natural gas almost completely.

In the area of energy uses, the year saw two large textile companies invest in exploration of solar potential on a serious scale. The purpose in both cases was to preheat process water, a source of considerable expense in the past. The larger and more expensive installation (at 2000 square metres of solar panels it is the second largest in Canada) is reported as saving \$35,000 per year, approximately 10% of the former heating cost. A smaller installation with 900 square metres of panels saves 7%.

In the larger installation the panels, standing free of the buildings in an adjoining field, were erected on the site. More recent concepts project savings in construction costs by using preassembled solar units. An existing recovery system for preheating feeds the solar equipment from which water returns to the plant for additional energy gains.

Activities

Serious business setbacks from import penetration in the early 80's had put a strain on the time and efforts of voluntary personnel who contribute to the success of the Technical Liaison Subcommittee, source of the concrete plans for energy conservation. This situation has now been righted and the committee, working with the Department of Energy, Mines and Resources, has designed a series of seminars to extend over a number of years. Three seminars per year are projected, each using one of the excellent EMR technical manuals as a basic teaching tool. Separate seminars will be given in English and French. Industry and university personnel will deliver papers tying specific concerns of the textile industry to the topic of the manual. The manual and copies of the papers delivered will build a personal energy library for each attendee and these in turn are planned for use in later in-plant studies sessions that will reach the man at the machine with up-to-date technical information on energy management.

**Textile Industry
Energy Efficiency Improvement**

Current year (1986) total energy inputs	11,239,734 gigajoules
New base year (1985) equivalent energy inputs	10,987,032 gigajoules
Net improvement =	-2.3%
Adjustments — None	
Efficiency gain 1974 - 1985	22.1%
Total gain 1974 - 1986	19.8%

**Textile Industry
Energy Use**

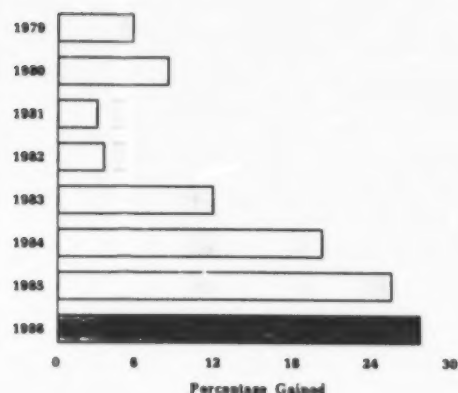
<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>Percentage of Total Consumed</u>	
			<u>1986</u>	<u>1985</u>
Natural Gas	144,407,000 m ³	5,371,940	47.8	54.5
Electricity	872,704 MWh	3,141,734	28.0	29.1
Liquid Petroleum Products				
Distillate Oil	649 kilolitres	25,292	0.2	0.3
Residual Oil	62,487 kilolitres	2,643,200	23.5	15.3
Diesel and Gasoline	1,000 kilolitres	38,050	0.3	0.1
Other Fuels				
Propane and LPG	556 m ³	14,790	0.1	0.5
Other Gaseous Fuels	94m ³	4,728	—	0.1
Total		11,239,734		



Transportation Industry (Manufacturing)

Energy Conservation Task Force

George Heidebrecht
Chairman



Task Force Description

The Transportation Industry (Manufacturing) Energy Conservation Task Force was established in 1975 to promote energy management and conservation among the membership of six participating trade associations:

- Aerospace Industries Association of Canada (AIAC)
- Allied Boating Association of Canada (ABAC)
- Automotive Parts Manufacturers Association (APMA)
- Canadian Shipbuilding and Ship Repairing Association (CSSRA)
- Canadian Truck and Trailer Manufacturers Association (CTTMA)
- Motor Vehicle Manufacturers' Association (MVMA)

These six trade associations represent 411 companies of various size. Although only 64 companies reported their energy consumption for 1986, they do use 80% of the total

energy consumed by the transportation sector. These 64 are, in general, larger companies which practise organized energy management and conservation.

Performance

During 1986, compared with the new base year of 1985, an overall improvement in efficiency of 2.17% was realized. This achievement is the result of improved economic conditions, improved productivity and housekeeping, as well as the implementation of more efficient equipment.

The 2.17% gain compares favourably with the target of 2.0% per year and indicates that the goal of 10% improvement by 1990 will most likely be achieved.

The previous gain in energy efficiency, from 1978 to 1985, was 25.6%.

Subsector Performance

An excellent one year improvement of 5.26% was made by the Aerospace Industries Association.

Motor Vehicle Manufacturers' Association, with an improvement of 1.98% and the Automotive Parts Manufacturers Association with an improvement of 2.69%, indicate that they should have little difficulty in achieving their goals over the next five years.

The Canadian Shipbuilding and Ship Repairing Association report a disappointing decrease in efficiency of 19.42%.

Also disappointing is the fact that no reports were received from the Allied Boating Association and the Canadian Truck and Trailer Manufacturers Association.

Energy Use Patterns

A definite shift from residual oil (No. 6 oil) to natural gas and a slight, but steady increase in the use of electricity are indicated.

Since 1978 the share of residual oil has dropped from 24.4% to 1.8%, while the share of natural gas has risen from 37.1% to 55.7%.

At the same time, the share of electricity has increased from 23.3% to 30.7%. As plants become more automated, electricity, because of its ease of control, will gain in popularity.

The use of propane, even though its share is rather small, has increased from .2% to .5%.

As we are presently experiencing a drastic reduction in the price of natural gas and a steady increase in the cost of electricity, it remains to be seen what the future trend will be.

Task Force Activities

The task force will continue to promote energy management and energy conservation as it has done in the past.

Because of the recent lack of interest in energy conservation, the task force has embarked on a new promotional campaign to rekindle its importance.

In addition to the above, we plan to enclose with the request for the 1987 energy data a computer disc containing a customized "Lotus" program for recording and calculating energy consumption. Hopefully this will generate new interest in the reporting of data as well as alleviating some of the tedious chores associated with its compilation.

The "Idea Exchange Letter" has retained its popularity and continues to be published on a monthly basis. Presently the letter is distributed to approximately 1000 industries, including several firms outside the country.

Task force meetings continued on a regular basis in order to gather and exchange information regarding energy programs and government policies. The meetings were attended by representatives from industry, the federal Department of Energy, Mines and Resources, the provincial Ministries of Energy and invited technical advisors from local utilities.

Future Outlook and Concerns

All indications are that, in 1987, we will again enjoy a healthy economy similar to that of 1986. However,

being faced with the ever increasing onslaught of offshore competition, we must, in order to retain this healthy economy, continue to improve our productivity and energy management.

The disappointing response to the 1986 survey and the declining participation by some of the various task force subsectors indicate a disturbing lack of interest in energy conservation. This could be the result of recent low gas and oil prices, overloaded company staff, or simply attitudinal problems which suggest that all possible energy conservation improvements have been made.

In spite of the above situation, the Transportation Industry Task Force feels that, using 1985 as the new base year, the goal of a 10% improvement in energy efficiency by 1990 can still be achieved.

Transportation Industry Energy Efficiency Improvement

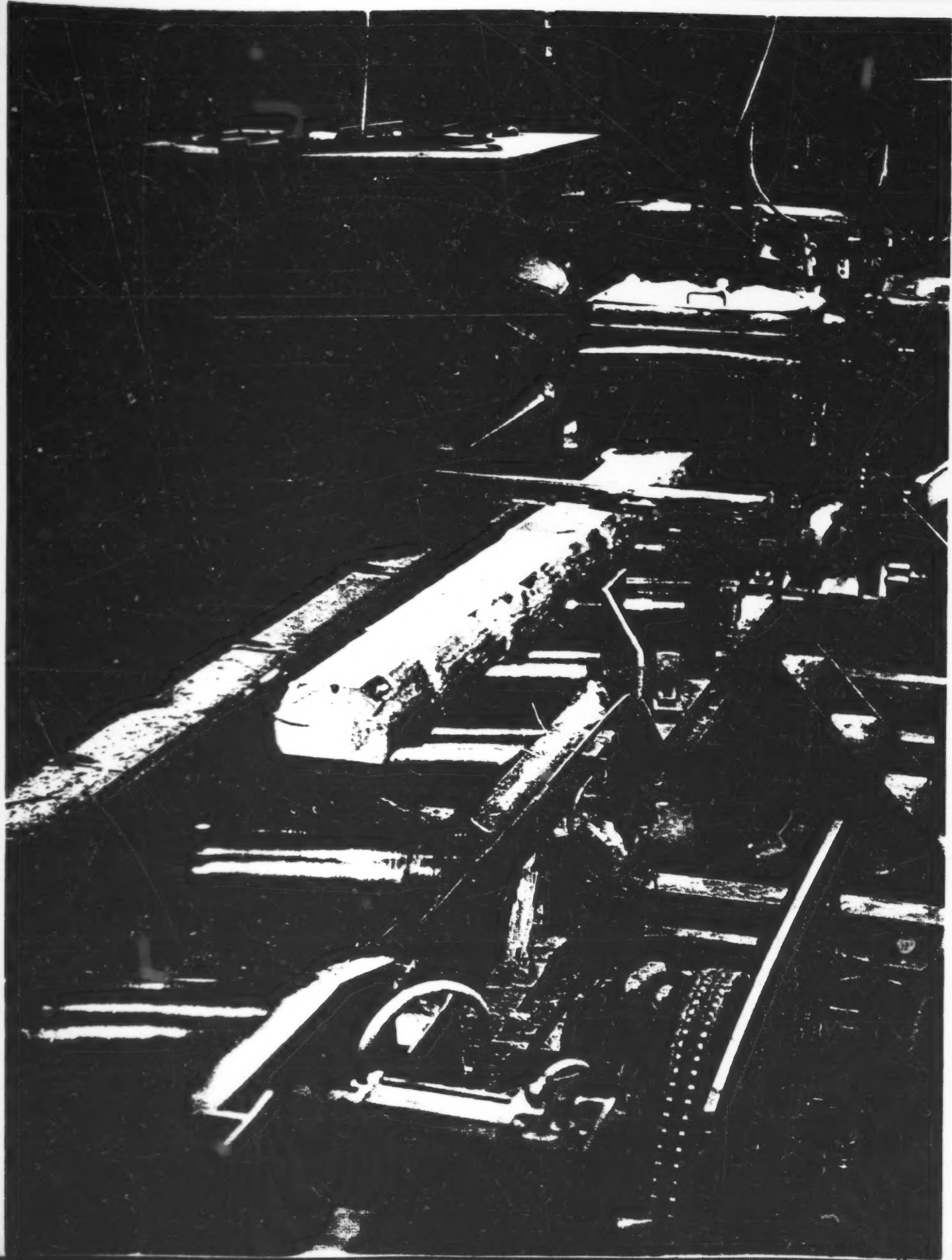
Current year (1986) total energy inputs	44,512,514 gigajoules
New base year (1985) equivalent energy inputs	45,499,677 gigajoules
Net Improvement =	2.1%
Adjustments — None	
Efficiency gain 1978 - 1985	25.6%
Total gain 1978 - 1986	27.7%

**Transportation Industry
Energy Use**

<u>Type</u>	<u>Units</u>	<u>Gigajoules</u>	<u>Percentage of Total Consumed</u>						
			<u>1986</u>	<u>1985</u>	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1980</u>	<u>1978</u>
Natural Gas	657,414,995 m ³	24,811,657	55.7	54.7	54.1	52.1	53.0	49.1	37.1
Electricity	3,792,085 MWh	13,651,506	30.7	30.1	29.3	28.4	26.9	23.6	23.3
Liquid Petroleum Products									
Distillate Oil	14,881,578 litres	584,004	1.3	1.2	1.2	1.4	1.8	0.7	1.2
Crude Oil	2,194,149 litres	85,571	0.2	—	—	—	—	—	—
Residual Oil	18,969,263 litres	803,198	1.8	2.1	3.6	6.3	7.5	14.7	24.4
Gasoline	821,341 litres	30,187	0.1	0.1	0.1	0.1	0.5	0.2	0.2
Diesel	1,337,922 litres	54,478	0.1	0.2	0.3	0.2	0.4	0.3	0.1
Coal	51,076 tonnes	1,543,516	3.5	3.5	3.8	4.0	3.9	5.9	6.7
Coke	98,425 tonnes	2,699,908	6.1	7.5	7.3	7.2	5.6	5.1	6.8
Other Fuels									
Propane	9,195,320 litres	245,883	0.5	0.6	0.3	0.3	0.4	0.4	0.2
LPG	104,265 litres	2,606	—	—	—	—	—	—	—
Total		44,512,514							

**Transportation Industry
Energy Efficiency**

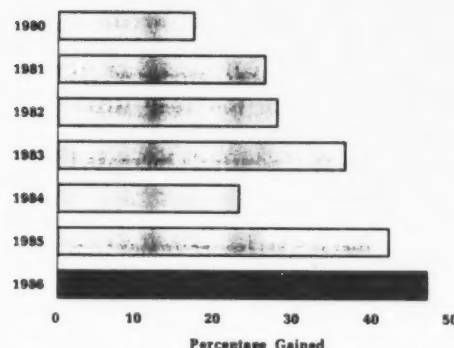
<u>Subsector</u>	<u>Base Year 1985</u>		<u>Base Year 1978</u>			
	<u>1986</u>	<u>1985</u>	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
ABAC (Boating)	—	—	12.9	3.1	-48.5	—
AIAC (Aerospace)	5.26	20.6	7.9	7.3	3.9	—
APMA (Autoparts)	2.69	6.5	13.5	11.7	5.8	—
CSSRA (Shipbuilding)	-19.42	11.4	-2.9	-10.6	-21.1	—
CTTMA (Truck/Trailer)	—	—	—	-56.9	-65.2	—
MVMA (Motor Vehicles)	1.98	28.8	22.8	-6.3	3.3	—
Task Force	2.17%	25.6%	20.3%	1.2%	3.7%	3.2%



Wood Products Industry (Western)

Energy Conservation Task Force

R.C. Bryan
Chairman



Task Force Description

The Wood Products Industry (Western) Task Force was formed by the Council of Forest Industries of British Columbia (COFI) and represents 80 companies with more than 100 sawmills and 15 plywood and veneer mills. COFI members and affiliates account for more than 90% of the total product value of the forest industries in B.C.

Most mills in western Canada are members of industry trade associations which are active with a wide variety of business issues of common interest. In British Columbia, the major forest industry associations are the Council of Forest Industries of B.C., its Northern Interior Lumber Sector (NILES), the Cariboo Lumber Manufacturers' Association (CLMA) and the Interior Lumber Manufacturers' Association (ILMA). CLMA and ILMA are also affiliate members of COFI.

This survey covers 50 operating sawmills owned by 20 companies, which accounted for 32% of all the lumber produced in B.C. in 1986. The reporting survey covers mills of all sizes and represents all regions of the province.

Goals and Progress to Date

The industry's goal for 1990 is a 7% increase from 1985 base year performance. The goal which the industry set for itself of a 15% reduction in purchased energy to be achieved by 1985, was surpassed several years ago. The industry's overall energy efficiency in 1986 showed an 8.1% improvement over the 1985 base year — a 47% improvement over the 1978 base year.

Average electrical energy consumption for the production of green lumber lost ground in 1986 and was 7.7% higher in 1986 than in 1985. Compared with 1978, how-

ever, the 1986 performance represented a 12.6% improvement.

The average natural gas consumption in the kiln drying of lumber in 1986 declined by 22.5% compared with the 1985 level, but taking the 1978 level, the reduction was 64.6%.

The size of the sample for 1986 was higher than might have been expected considering that some of the reporting mills were shut down for up to four-and-one-half months as the result of a partial industry strike. Also, a number of companies which had reported in the earlier years of the survey ceased to report a year ago as a result of constraints on staff resources. Despite our best efforts, these companies did not report again this year.

Although the demand for lumber increased in 1986, the industry spent the year fighting protectionist efforts by the United States and as mentioned earlier, a portion of the

B.C. wood products industry was involved in a work stoppage as a result of the strike.

The increased consumption of electricity in 1986 reflected a decline in the sector's electrical energy efficiency from the level of the previous year. A check of the reporting mills indicates that in virtually all cases where mills reported significant declines in production in 1986 over 1985, they also reported significant increases in average electrical energy consumption per thousand board feet of lumber produced. It would appear that the 1986 strike played a role, and probably a significant one, in the industry's increased use of electricity.

The substantial improvement in energy efficiency in dry kilns is largely a result of conversions from natural gas-fired kilns to wood waste-fired energy systems. This permits an internally generated fuel, wood waste, to be substituted for purchased fuel. In addition, improvements in the circulation of the hot air drying stream and increased insulation have also contributed by making natural gas-fired kilns more energy-efficient.

Task Force Activities

In addition to the substantial permanent staff reductions made during the period 1982 to 1986, the recent 15% export charge on lumber destined for the U.S. has caused lumber manufacturers to look at further ways to reduce costs. This is likely to continue to impact on the participation in external activities which company personnel have undertaken in the past. Task force activities continue to be affected. However, efforts to reactivate the task force will continue.

Future Outlook

The 15% export charge on lumber exports to the United States is the key element in the array of uncertainties affecting the wood products sector. Although it raises the breakeven point for sawmills, at present levels of lumber prices the export charge has had little visible impact on the sector. However, even with relatively strong markets it will siphon off an anticipated \$600 million annually which could otherwise be reinvested to maintain the industry's competitive position.

Exchange rates present another uncertain element in industry forecasting. The welcome adjustment between North American and offshore currencies has meant that Canadian wood products are again competitive in offshore markets and exports have increased correspondingly. However, with approximately two-thirds of our lumber production exported to the U.S., the recent strengthening of the Canadian dollar vis-à-vis the U.S. dollar is a negative for the industry.

In their efforts to cut costs, Canadian lumber producers will be looking at further cost reducing measures in 1987 and beyond. In this context, lumber producers will likely be actively pursuing wood waste energy conversion systems since reductions in natural gas prices to this customer class have been relatively modest and improved forest industry profits are making more investment funds available.

Wood Products Industry (Western)
Energy Efficiency Improvement

<u>Green Lumber</u>	<u>1986</u>	<u>1985</u>	<u>1978</u>
Total sample production (million board feet — MMFBM)	4240.5	5052.0	4202.2
Total energy consumption (10^{12} J)	2027.1	2241.5	2297.7
Average electrical energy consumption (10^9 J per MFBM)	0.478	0.444	0.547
Current year total electrical energy inputs (10^{12} J)	2027.1	2241.5	2297.7
Comparison base year (1985) equivalent energy inputs (10^{12} J)	1881.4		
Comparison base year (1978) equivalent energy inputs (10^{12} J)	2318.6		

$$\text{Improvement (1985 base year)} = \frac{1881.4 - 2027.1}{1881.4} \times 100 = -7.7\%$$

$$\text{Improvement (1978 base year)} = \frac{2318.6 - 2027.1}{2318.6} \times 100 = 12.6\%$$

<u>Kiln Dried Lumber</u>	<u>1986</u>	<u>1985</u>	<u>1978</u>
Total sample production (MMFBM)	2672.0	3159.4	1013.0
Total energy consumption (mainly natural gas) 10^{12} J	1594.5	2433.0	1708.8
Average energy consumption (10^9 J per MFBM)	0.597	0.770	1.687
Current year total energy inputs (10^{12} J)	1594.5	2433.0	1708.8
Comparison base year (1985) equivalent energy inputs (10^{12} J)	2057.7		
Comparison base year (1978) equivalent energy inputs (10^{12} J)	4507.3		

$$\text{Improvement (1985 base year)} = \frac{2057.7 - 1594.5}{2057.7} \times 100 = 22.5\%$$

$$\text{Improvement (1978 base year)} = \frac{4507.3 - 1594.5}{4507.3} \times 100 = 64.6\%$$

<u>Combined Energy Performance</u>	<u>1986</u> <u>Actual</u>	<u>1985</u> <u>Equiv.</u>	<u>1978</u> <u>Equiv.</u>
Total electrical energy consumption (Green Lumber 10^{12} J)	2027.1	1881.4	2318.6
Total natural gas consumption (Kiln Dried 10^{12} J)	1594.5	2057.7	4507.3
Total sector energy consumption 10^{12} J	3621.6	3939.1	6825.9

$$\text{Improvement (1985 base year)} = \frac{3939.1 - 3621.6}{3939.1} \times 100 = 8.1\%$$

$$\text{Improvement (1978 base year)} = \frac{6825.9 - 3621.6}{6825.9} \times 100 = 47.0\%$$



Reporting Companies

Chemical

Alberta Gas Chemicals Ltd.
 Allied Canada Limited
 Ashland Chemicals
 Atkemix Inc.
 BASF Canada Inc.
 Blachford, H.L., Ltd./Ltée.
 Borden Chemical
 Borg-Warner Chemicals
 C-I-L Inc.
 Canadian Occidental Petroleum Ltd.
 Carlew Chemicals Limited
 Celanese Canada Inc.
 Commercial Alcohols Limited
 Cyanamid Canada Inc.
 Diamond Shamrock Canada Ltd.
 Dominion Colour Company
 Domtar Chemicals Group
 Dow Chemical Canada Inc.
 Du Pont Canada Inc.
 Emery Chemicals Ltd.
 Erco, a Division of
 Tenneco Canada Inc.
 Esso Chemical Canada
 Ethyl Canada Inc.
 General Chemical Canada Ltd.
 Goodrich, B.F., Canada Inc.
 Hart Chemical Limited
 Hercules Canada Inc.
 Himont Canada Inc.
 Hoechst Canada Inc.
 Monsanto Canada Inc.
 Nacan Products Limited
 National Silicates Limited
 Nitrochem Inc.
 NL Chem Canada Inc.
 Noranda Sales Corporation Ltd.
 Novacor Chemicals Ltd.
 Nuodex Canada Limited
 Ocelot Industries Ltd.
 PPG Canada Inc.
 Pétromont Inc.
 Pigment & Chemical Inc.
 Polyresins Inc.
 Polysar Limited
 Procter & Gamble Inc.
 QuéNord Inc.

Reed Inc.
 Rohm & Haas Canada Inc.
 Shell Canada Chemical Company
 Sulco Chemicals Limited
 Sunchem, a Division of Sunoco Inc.
 Tioxide Canada Inc.
 Union Carbide Canada Limited
 Uniroyal Chemical

Electrical and Electronic

Alcan Wire and Cable
 Allanson, Division of Jannock Ltd.
 Arcair of Canada
 Ascoelectric Ltd.
 Bayly, A.E.G., Inc.
 B.B. Howden Inc.
 BBC Brown Boveri Canada Inc.
 Black and Decker Canada Inc.
 Burndy Inc.
 Canada Wire and Cable Limited
 Canadian General Electric
 Co. Limited
 Columbia International
 Commander Electrical Materials Inc.
 Eaton Yale Ltd.
 Edwards, A Unit of
 General Signal Ltd.
 Federal Pioneer Limited
 Garrett Canada
 General Wire and Cable
 Gould Electronics
 Honeywell Limited
 Iona Appliances Inc.
 Linear Technology
 Maloney Electric Corp.
 Manville Canada Inc.
 Marine Industrie Limitée
 Microelectric Canada Ltd.
 Motorola Information Systems Ltd.
 PCG Switchgear Ltd.
 RCA Inc.
 Spar Aerospace Ltd.
 Sunbeam Corporation (Canada)
 Limited

Texas Instruments Inc.
 3M Canada Inc.
 Westinghouse Canada Inc.

Ferrous Metals

Algoma Steel Corporation
 Dofasco Inc.
 Sidbec-Dosco Inc.
 Stelco Inc.
 Sydney Steel Corporation (Sysco)

Food and Beverage

Association of Canadian Biscuit Manufacturers

Cristie Brown and Company Ltd.
 Colonial Cookies Ltd.
 Culinar Inc.
 Dare Foods Limited
 InterBake Foods Limited
 Manning Biscuits Ltd.

Association of Canadian Distillers

Alberta Distillers Limited
 Canadian Mist Distillers Limited
 Corby Distilleries Ltd.
 FBM Distillery Co. Limited
 Gilbey Canada Inc.
 Gooderham & Worts
 Hiram Walker & Sons Limited
 McGuinness Distillers Limited
 Palliser Distillers Limited
 Schenley Canada Inc.
 Seagram, Joseph E., & Sons, Limited

Bakery Council of Canada

Ben's Limited
Corporate Food Limited
Eastern Bakeries Limited
McGavin Foods Limited
Multi-Marques Inc.
Weston Bakeries Limited

Brewers Association of Canada

Carling O'Keefe Breweries
Labatt Brewing Company Limited
Molson Breweries of
Canada Limited
Moosehead Breweries Limited
Northern Breweries Ltd.
Pacific Western Brewing Co. Ltd.
Upper Canada Brewing Co. Ltd.

Canadian Food Processors Association

Campbell Soup Company Ltd.
Canadian Cannery Limited
Fraser Valley Foods Ltd.
Grantham Foods Ltd.
Heinz, H.J., Company of
Canada, Ltd.
Hunt-Wesson Canada Ltd.
Kraft Limited
Lassonde, A., & Fils Inc.
Libby, McNeill & Libby Inc.
Lord, David, Limitée
Morrison Lamothe Frozen
Foods Ltd.
Nabisco Brands Ltd.
Omstead Foods Limited
Produce Processors Limited
Produits Ronald Ltée
Smith, E.D., & Sons Limited
Snowcrest Packers Ltd.
Strathroy Foods Limited
Sun-Brite Canning Ltd.
Thomas Canning (Maidstone) Ltd.

Canadian Meat Council

Burns Meats Limited
Canada Packers Inc.
Fearman, F.W., Company Limited
Intercontinental Packers Ltd.
IXL Limited
Les Aliments Hygrade Inc.
Piller Sausages & Delicatessen Ltd.
Quality Meat Packers Ltd.
Schneider, J.M. Inc.
Supreme Packers Inc.
Vancouver Fancy Meats Co. Ltd.

Canadian Poultry and Egg Processors Council

Canada Packers Inc.
Export Packers Company Limited

Highland Produce Ltd.
Lashbrook Produce Limited
Lilydale Co-op Ltd.
Lucerne Foods Ltd.
Maple Lynn Foods Ltd.
P & H Foods Ltd.
Pinecrest Foods Limited
Volco Inc.

Canadian Soft Drink Association

Beverage Central Ltd.
Blackwoods Beverages Ltd.
Cassidy's Beverages
Coca-Cola Ltd. (Alberta)
Coulombe Québec Limitée
Desormeaux, S., Inc.
Erie & Huron Beverages Ltd.
Gray Beverage Company Ltd.
Gray Beverages (Alberta) Ltd.
Gray Beverages (Island) Co.
HPI Beverages Ltd.
Ideal Sport Inc.
Larrivée et Frères Inc.
Misener Beverages Ltd.
Northern Beverage Inc.
Roux et Bergeron Inc.
Sarnia Beverages Ltd.
Saskal Beverages Ltd.
Seven-up (Saskatoon) Ltd.
Simard, Philippe, & Fils Ltée
Starlite Bottlers Limited
Thames Valley Beverages Ltd.

Canadian Sugar Institute

British Columbia Sugar Refining
Company Limited
Lantic Sugar Limited
Redpath Sugars Limited
St. Lawrence Sugar Division
Natalik Inc.
Westcane Sugar Limited

Confectionery Manufacturers of Canada

Adams Brands Inc.
Cadbury Schweppes Powell Inc.
Dare Foods Limited
Hershey Canada Inc.
Laura Secord Inc.
Leaf Confections Ltd.
Life Savers Canada Ltd.
Lowney Inc.
Neilson, William, Ltd./Ltée
Rowntree, Mackintosh Canada Ltd.
Wrigley Canada Inc.

Fisheries Council of Canada

British Columbia Packers Limited
Connors Bros. Limited

National Sea Products Limited
Omstead Foods Limited

Grocery Products Manufacturers of Canada

Borden Company Limited,
The Consumer Products Division
Canadian Home Products Limited
Catelli Limited
Culinar Inc.
Fleischman Company Limited
Gerber (Canada) Inc.
Lancia Bravo Foods Limited
Lipton, Thomas J., Inc.
Nabisco Brands Ltd.
Nabisco Food Services
Nabob Foods Ltd.
Omstead Foods Limited
Planters Peanuts Ltd.

Starch Council of Canada

Casco Company
Nacan Products Ltd.
Ogilvie Mills Ltd.
St. Lawrence Starch Co. Ltd.

General Manufacturing

Rubber Products

Camoplast Inc.
Firestone Canada Inc.
Gates Canada Inc.
General Tire Canada Limited
Goodall Rubber Company
of Canada Ltd.
Michelin Tires (Canada) Ltd.
Trent Rubber Services Limited
Uniroyal Goodrich Canada Inc.

Chemical, Pharmaceutical and Medical Products

Canadian Occidental Petroleum
Limited
Ethicon Ltd.
Henkel Chemicals (Canada) Limited
Johnson & Johnson Inc.
Merck Frosst Canada Inc.
Tambrans Canada Inc.
Valspar Chemicals Ltd.

Foundries, Forgings and Heavy Metal Processors

Slater Steels Inc.
Brass Craft Canada Limited
Brown Foundry Ltd.
Canada Forgings Inc.

Canada Metal Company Limited
 Canadian Bronze Company Limited
 Canron Inc.
 Canvil Ltd.
 Esco Ltd.
 Fonderie St. Romuald Inc.
 Fonderies Magotteaux Canada Ltée.
 Gray Forgings & Stampings Limited
 Huron Steel Products (Windsor) Ltd.
 Lake Ontario Steel Company
 Limited
 Manville Canada Inc.
 Metals & Alloys Company Limited

Light Manufacturing

American Standard Inc.
 Atco Limited
 Atlantic Industries (N.B.) Ltd.
 Bird Archer Inc.
 Black and Decker Canada Inc.
 Bombardier Inc.
 Bundy of Canada Ltd.
 Canadian General-Tower Ltd.
 Cleaver-Brooks of Canada Ltd.
 Climate-Master, Division of
 Bow Valley Ltd.
 Commercial Aluminum, Division
 of Indal Ltd.
 Crane, R.L., Inc.
 DeVilbiss (Canada) Limited
 Dorr-Oliver Canada Limited
 Fasco Products, Division of
 Indal Ltd.
 Imperial Tobacco Ltd.
 Indal Limited
 Indal Technologies Inc.
 Indalloy, Division of Indal Ltd.
 Ivex Corporation
 Jarvis Clark
 Kawneer Company Canada Limited
 Kodak Canada Inc.
 Leitz, Ernst Canada Limited
 Lite Metals, Division of Indal Ltd.
 Maclean Hunter Company Limited
 NCR Canada Ltd.
 Oneida Canada Limited
 Paddle Valley Products Limited
 RJR-MacDonald Inc.
 Seneca (St. Catharines)
 Mfg. Ltd.
 SKD Manufacturing
 Teledyne Canada Metal Products
 Temprite Industries Ltd.
 Trane Canada
 W.C. Wood Limited

Industrial Minerals

Abrasives

Exolon-Esk Company of Canada Ltd.
 General Abrasives Canada Limited
 Norton Canada Inc.
 Sohio Electro Minerals Inc.
 Washington Mills Ltd.

Asbestos

Brinco Mining Ltd., Cassiar Division
 Carey Canada Inc.
 Cassiar Mining Corporation
 Lab Chrysotile Inc.
 JM Asbestos Inc.

Cement

Canada Cement Lafarge Ltd.
 Ciment Québec Incorporated
 Federal White Cement Limited
 Genstar Cement Limited
 Lake Ontario Cement Limited
 Miron Inc.
 North Star Cement Limited
 St. Lawrence Cement Inc.
 St. Marys Cement Company

Clay Brick and Tile

Briqueterie St-Laurent Ltée
 Canada Brick Company Limited
 Canada Vitriified Products Limited
 Estevan Brick Limited
 Medicine Hat Brick and Tile Ltd.
 Medicine Hat Sewer Pipe Ltd.
 Northwest Brick and Tile Ltd.
 Redcliff Pressed Brick Ltd.
 Red River Brick Limited

Concrete Products

Boehmers Ltd.
 Canada Cement Lafarge Ltd.
 Con Force Structures Limited
 Consolidated Concrete Limited
 Doughty Concrete Products Ltd.
 Downey Building Materials Ltd.
 Richvale Block and Building
 Supply Ltd.
 York Block and Supply Limited

Glass

Consumers Packaging Inc.
 Domglas Inc.
 Fiberglas Canada Inc.
 Ford Glass Limited
 PPG Canada Inc.

Lime

Beachville Lime Ltd.
 Guelph DoLime Ltd.
 Reiss Lime Company of
 Canada Limited
 Summit Lime Works Limited

Miscellaneous Minerals

Canadian Gypsum Ltd.
 Indusmin Limited
 Steetley Talc Limited
 3M Canada Inc.

Refractories

Babcock & Wilcox Refractories
 Canadian Refractories Limited
 Clayburn Industries Ltd.
 General Refractories of
 Canada Limited
 Green, A.P., Refractories (Canada)
 North American Refractories Ltd.

Machinery

ACCO Canadian Material Handling,
 a Division of Dominion Chain Inc.,
 Beloit Canada Ltée/Ltd.
 Bingham International Inc.
 Boart Canada Inc.
 Canadian Blower/Canada Pumps
 Limited
 Canron Inc.
 Continuous Mining Systems Limited
 Crane Canada Inc., Valve &
 Industrial Division
 Dominion Engineering Works,
 a Division of Canadian General
 Electric Company Limited
 Dorr-Oliver Canada Limited
 Edson Packaging Machinery Limited
 EIMCO Jarvis Clark
 FAG Bearings Ltd.
 General Conveyor Co. Ltd.
 Greey Lightnin, Unit of General
 Signal Limited
 Heath & Sherwood (1964) Limited
 H.J. Langen & Sons Limited
 M.A.N. Ashton Inc.
 MTD Products Limited
 Mathews Conveyor Company,
 a Division of Rexnord Canada Ltd.
 Montreal Milling Cutter Co. Ltd.
 Motivation Industrial
 Equipment Ltd.
 Provincial Crane, AMCA Heavy
 Equipment Limited
 RMS Division, Uniroyal Goodrich
 Canada, Inc.

Smart Turner Limited
 Union Pump (Canada) Ltd.
 Valmet-Dominion Inc.
 Ward Ironworks Limited
 Worthington Pump Division,
 Dresser Canada, Inc.

Mining and Metallurgy

Cominco Ltd.
 Dome Mines Ltd.
 Falconbridge Limited
 Inco Limited
 Iron Ore Company of Canada Ltd.
 La Compagnie Minière Québec
 Cartier
 Noranda Inc.
 Rio Algom Limited
 Sherritt Gordon Mines Limited

Petroleum Refining

Esso Petroleum Canada
 Gulf Canada Products Company
 Husky Oil Operations Ltd.
 Petro-Canada Products Inc.
 Shell Canada Limited
 Suncor Inc.
 Syncrude
 Texaco Canada Inc.

Plastics

Abco Plastics Ltd.
 Allied-Halo Industries Inc.
 Amoco Fabrics and Fiber Ltd.
 American Bilrite (Canada) Ltd.
 Atlantic Packaging Products Ltd.
 Beaver Plastics Limited
 BMR Handbags Ltd.
 Bonar Rosedale Plastics Ltd.
 Canada Cup Inc.
 Canadian General-Tower Ltd.
 Canplas Industries Ltd.
 Canusa Coating Systems Ltd.
 Carlew Chemicals Ltd.
 Chemacryl Plastics Limited
 C-I-L Inc.
 Complx Corporation
 Daymond, a Division of Redpath Inc.
 English Plastics Inc.
 Fibracan Inc.
 Formica Canada Inc.
 F&H Plastics Ltd.
 Horn Plastics Limited
 Les Systèmes Thermoplast Inc.

Maple Leaf Plastics Limited
 Medallion Plastics Ltd.
 Modern Plastics Limited
 Monarch Plastics Ltd.
 Morbern Inc.
 Norseman Plastics Limited
 PCL Packaging Limited
 Plastics Holdings Limited
 Plasti-Drain Ltée
 Plastifab Industries Ltd.
 Plastmade Industries Ltd.
 Plax Inc.
 Poly Cello Limited
 Polyainers Limited
 Premier Plasticap Ltd.
 Propak Plastics Ltd.
 Remlech Manufacturing Ltd.
 Rubbermaid Canada Inc.
 Sauder Industries Ltd.
 Schlegel Canada Inc.
 Toronto Plastics Limited
 Waltec Plastics Ltd.
 Woodbridge Foam Corporation

Pulp and Paper

Abitibi-Price Inc.
 Atlantic Packaging Products Ltd.
 Armstrong World Industries
 Canada Ltd.
 Beaver Wood Fibre Company
 Limited
 Belkin Paperboard Limited
 Bennett Fleet Inc.
 Boise Cascade Canada Ltd.
 Bowater Mersey Paper Company
 Limited
 British Columbia Forest Products
 Limited
 Canadian Forest Products Ltd.
 Cariboo Pulp and Paper Company
 Cascades (East Angus) Inc.
 Cascades (Jonquière) Inc.
 Celgar Pulp Co.
 Champion Forest Products
 (Alberta) Ltd.
 CIP Inc.
 Consolidated-Bathurst Inc.
 Corner Brook Pulp and Paper Ltd.
 Crestbrook Forest Industries Ltd.
 Crown Forest Industries Limited
 Domtar Inc., Pulp and Paper
 Products
 Donohue Inc.
 Donohue Normick Inc.
 Donohue St. Félicien Inc.
 E.B. Eddy Forest Products Ltd.
 Eurocan Pulp and Paper Co. Ltd.
 La Cie J. Ford Ltée
 Fraser Inc.
 Gaspesia Pulp and Paper
 Company Ltd.

Great Lakes Forest Products Limited
 Industries James MacLaren Inc.
 Irving Pulp and Paper, Limited
 Island Paper Mills Limited
 James River-Marathon, Ltd.
 Kimberly-Clark of Canada Limited
 Kruger Inc.
 MacMillan Bloedel Limited
 Malette Kraft Pulp & Power
 Manfor Ltd.
 Minas Basin Pulp & Power
 Company Limited
 Miramichi Pulp & Paper Inc.
 NBIP Forest Products Inc.
 Northwood Pulp and Timber
 Limited
 Ontario Paper Company Limited
 Paperboard Industries Corporation
 Papier Cascades (Cabano) Inc.
 Perkins Paper Ltd.
 Procter & Gamble Inc.
 La Compagnie de Papier Q.N.S.
 Limitée
 Reed Inc.
 Rolland Inc.
 Rothesay Paper Limited
 St. Anne-Nackawic Pulp & Paper
 Company Ltd.
 St. Marys Paper Inc.
 Scott Maritimes Limited
 Scott Paper Limited
 Skeena Cellulose Inc.
 Sonoco Limited
 F.F. Soucy, Inc.
 Spruce Falls Power & Paper
 Company, Limited
 Stora Forest Industries
 Strathcona Paper Company
 Tembec Inc.
 Western Pulp Limited Partnership
 Weyerhaeuser Canada Inc.

Textiles

Albany International Canada Inc.
 Artex Woollens Limited
 Asten-Hill Inc.
 Ayers Limited/Limitée
 Badische Canada Inc.
 Barrymore Carpet Inc.
 Bay Mills Limited
 Bell Tootal Inc.
 Bermatex Inc.
 Borg Textiles Inc.
 Burlington Canada Inc.
 Canada Hair Cloth Co. Ltd.
 Concord, Division of the Hamilton
 Group Ltd.
 Celanese Canada Inc.
 Cleyn & Tinker Inc.

Coats, J.&P., (Canada) Inc.
 Collins & Aikman Inc.
 Consoltex Canada Inc.
 Courtaulds (Canada) Inc.
 Crossley Karastan Carpet Mills Limited
 De Ball, J.L., Canada Limited
 Dominion Textile Inc.
 Drytex, Division of JWI Ltd.
 Dura Undercushions Ltd.
 Glanmar Mills Ltd.
 Harding Carpets Limited
 Harvey Woods Limited
 Heuga Canada Ltd.
 Huntex Ltd.
 Huyck Canada Limited
 Kayser-Roth Canada Ltd.
 Leedye Inc.
 Les Tapis Artisans Inc.
 Les Tapis Peerless Ltée.
 McGregor Hosiery Mills
 Niagara Lockport Québec Industries
 Nova Scotia Textiles Limited
 Ozite Canada (1981) Inc.
 Patons & Baldwins Canada Inc.
 Paton, C&T Inc.
 Penmans, Division of
 Dominion Textile
 Poli-Twine, Division of Building
 Products of Canada Limited
 Rayonese Textile Inc.
 Reeves Bros. Canada Ltd.
 Riverside Yarns Limited
 Royal Knitting Company Limited
 Rubyco Inc.
 Satexil Inc.
 Sauquoit Industries Ltd.
 Silkknit Ltd.
 Spinrite Yarns & Dyers Ltd.
 Springdale Canada Inc.
 Tapis Coronet Inc.
 Tapis Venture du Canada Ltée.
 Textiles F.D.L. Inc.
 Textile Manufacturing Co. Limited
 Textiles Dionne Inc.
 Tissus Hafner du Canada Ltée.
 Tricots Canada U.S. Inc.
 Tricots Duval & Raymond Ltée.
 Tricots Majestic Limitée
 Tricots Richelieu Inc.
 Tricots Smart Fabrics Inc.
 Vagden Mills Limited
 Waterville Cellular Products Ltd.
 West Coast Woollen Mills Ltd.
 White Buffalo Mills Ltd.
 Zephyr Inc.

Transport

Aerospace Industries Association of Canada

Advance Power (1984) Inc.
 Aircraft Appliances and Equipment Limited
 Bendix Avelex Inc.
 Canadian Marconi Company
 Canadair Limited
 Chicopee Manufacturing Limited
 Computing Devices Company,
 a Division of Control Data
 Canada Ltd.
 deHavilland Aircraft of Canada Limited
 Field Aviation East Ltd.
 Garrett Canada
 Genaire Limited
 Haley Industries
 Hawker Siddeley Canada Inc.
 Indal Technologies Inc.
 Kaycom Inc.
 Litton Systems Canada Limited
 McDonnell Douglas Canada Ltd.
 MEL Defence Systems Ltd.
 Menasco Aerospace Ltd.
 Rockwell International of
 Canada Ltd.
 Spar Aerospace Limited

Automotive Parts Manufacturers' Association

Algoods, Division of Aluminum
 Company of Canada Ltd.
 Amcan Castings Limited
 B & W Heat Treating (1975) Limited
 Bendix Electronics Limited
 Blackstone Industrial Products Ltd.
 Budd Canada Inc.
 CAE Accurcast
 CAE Diecast
 Canada Forgings Inc.
 Canada Metal Company Limited
 Champion Spark Plug Co. of Canada
 Limited
 Daymond, a Division of Redpath
 Industries Limited
 Duplate Division PPG Canada Inc.
 FAG Bearings Ltd.
 Galtaco Inc.
 Gates Canada Inc.
 Goodyear Canada Inc.
 Hayes-Dana Inc.
 Hoover Universal of Canada
 Kelsey-Hayes Canada Limited
 Mastico Industries Limited
 Medallion Plastics Limited
 Metals & Alloys Company Limited
 MTD Products Limited
 P & M Coatings Limited

Reynolds Aluminum Company of
 Canada Ltd.

R.J. Simpson Manufacturing
 Company (Canada) Limited
 Slater Steels Corporation
 Stemco Canada, Truck Products
 Division
 Thomson (Canada) Rivet Co. Limited
 Thyssen Marathon Canada Ltd./Ltée
 TRW Canada Limited, Thompson
 Products Division
 Union Drawn Steel Company
 Waltec Plastics

Canadian Shipbuilding and Ship Repairing Association

Marine Industrie Limitée
 Marystown Shipyard Limited
 Saint John Shipbuilding Limited
 Versatile Davie Inc.

Motor Vehicle Manufacturers' Association

American Motors (Canada) Inc.
 Chrysler Canada Ltd.
 Ford Motor Company of Canada,
 Limited
 General Motors of Canada Limited
 Volvo Canada Ltd.

Wood Products (Western)

Balfour Forest Products Inc.
 Canadian Forest Products Ltd.
 CIP Inc., Tahsis Pacific Region
 CIPA Lumber Co. Ltd.
 Crestbrook Forest Industries Ltd.
 Evans Products Co. Ltd.
 Federated Co-Operatives Ltd.
 Finlay Forest Industries Ltd.
 Gorman Bros. Lumber Ltd.
 Groot, D., Logging Ltd.
 MacMillan Bloedel Ltd.
 Nechako Lumber Co. Ltd.
 Northwood Pulp & Timber Ltd.
 The Pas Lumber Company Ltd.
 Quesnel Forest Products,
 Division of Slocan
 Riverside Forest Products Ltd.
 Silvertree, Division of Whonnock
 Weldwood of Canada Limited
 Weyerhaeuser Canada Ltd.
 Zeidler Forest Industries Ltd.

Appendix A

Reporting Methodology

The objective of the CIPEC monitoring system is to track as closely as possible the actual changes in production energy intensity. Performance monitoring procedures and accounting methodology used by the task forces follow a prescribed aggregating method established by CIPEC in 1975.

The basis of the CIPEC method is to compare energy consumption to physical units of production, where possible. This is done by determining the difference in current year and base year energy-intensities, which is the same as a comparison of the current year consumption with the energy that would have been used in a base year (at the same level of production) before any efficiency improvements had taken effect.

The quantity of energy savings claimed is calculated as the difference between the total current year energy consumption and the base year equivalent energy consumption. Each year the base year equivalent energy consumption is deter-

mined by aggregating the results of each participating company. This method of determining changes in energy-intensities thus incorporates the total effects of changes in production-mix, production volumes, technologies, and energy conservation activities.

Feedstocks used in the Chemical and Petroleum Refining industries are not included in the task force or CIPEC accounting system since conservation of these commodities is not an issue. However, process improvements which register as site throughput reductions and improve total energy intensities are regarded as conservation of energy. In the Ferrous Metal industry, the metallurgical coal that is used to make coke for steel manufacture is treated as a primary fuel input.

Since reporting began, it has been necessary to apply minor adjustments to the consumption numbers to normalize the effect of fluctuations in weather, added energy con-

sumption from imposed environmental equipment, and periodic changes in raw material quality. These corrections are done at the individual company level which often reports both gross and net efficiencies. This procedure will be continued to allow participants to make future adjustments if necessary.

After a decade of CIPEC monitoring, the task forces advised their participating companies to update individual reference years to 1985 to recognize the many fundamental changes that have occurred since the beginning of the program. Reporting of future performances will carry forward the past achievements, however, to retain the long-term trends in performance.

Appendix B

Conversion Factors

Prefix	Multiple	Symbol
kilo	10^3	k
mega	10^6	M
giga	10^9	G
tera	10^{12}	T
peta	10^{15}	P
exa	10^{16}	E

Energy	Metric	Imperial
Electricity – net	3.6 MJ/kWh	3413 BTU/kWh
– gross	10.551 MJ/kWh	10000 BTU/kWh
Natural Gas	37.2 MJ/m ³	1.00×10^6 BTU/MCF
Propane	26.6 MJ/litre	0.1145×10^6 BTU/IG
Crude Oil	38.5 MJ/litre	5.8×10^6 BTU/bbl
Distillate Oil	39.0 MJ/litre	0.168×10^6 BTU/IG
Residual Oil (2.5% <i>s</i>)	42.3 MJ/litre	0.182×10^6 BTU/IG
Coal-Bituminous	32.1 GJ/tonne	27.6×10^6 BTU/ton
–Subbituminous	22.1 GJ/tonne	19.0×10^6 BTU/ton
–Metallurgical	29.0 GJ/tonne	25.0×10^6 BTU/ton
Coke-Petroleum-raw	23.3 GJ/tonne	20.0×10^6 BTU/ton
Gasoline	36.2 MJ/litre	0.156×10^6 BTU/IG
Diesel Fuel	39.9 MJ/litre	0.172×10^6 BTU/IG
Kerosene	38.8 MJ/litre	0.167×10^6 BTU/IG
LPG	27.1 MJ/litre	0.117×10^6 BTU/IG

Quantities

1 cubic metre of oil = 6.292 barrels
(15°C at 922 kg/m³) (60°F at 22°API)

1 cubic metre of natural gas = 35.301 cubic feet
(101.325 kp at 15°C) (14.73 psia at 60°F)

1 kilojoule = 0.948 BTU
1 tonne = 1.1023 tons
1 litre = 0.2199 IG
1 kg = 2.205 lbs.

The information, perspectives and data reported herein are solely the responsibility of the Canadian Industry Program for Energy Conservation Council and the reporting task forces.

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Energy, Mines and
Resources Canada

Énergie, Mines et
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**Canadian Industry
Program for
Energy Conservation**

